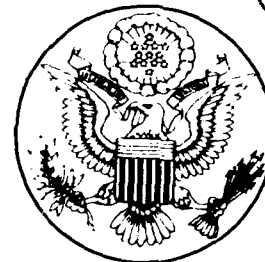


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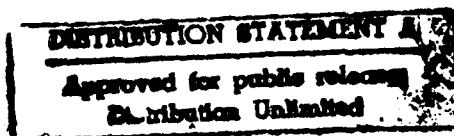
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(Production and Logistics)
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DEPARTMENT OF DEFENSE
FEDERAL
HAZARD COMMUNICATION
TRAINING PROGRAM
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TRAINER'S GUIDE



APRIL 1988

OFFICE OF THE ASSISTANT SECRETARY OF DEFENSE
(FORCE MANAGEMENT AND PERSONNEL)

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This Hazardous Communications Product was developed by **INTERACTIVE MEDICAL COMMUNICATIONS, INC.**, Waltham, MA, pursuant to Contract No. S-001-1062 with Dynamac Corporation, Contract No. DLA900-82-C-4426.

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ASSISTANT SECRETARY OF DEFENSE

WASHINGTON, D.C. 20301-4000

DoD 6050.5-G-1

FORCE MANAGEMENT
AND PERSONNEL

FOREWORD

This publication is issued under the authority of, and in accordance with DoD Instruction 6050.5, "Hazardous Material Information System," January 25, 1978. This publication, the "Department of Defense Federal Hazard Communication Training Program, Trainer's Guide," when used with the "Department of Defense Federal Hazard Communication Training Program, Student's Workbook" and the associated 90-minute videotape, provide training resources to help DoD comply with the training requirements of the Occupational Safety and Health Administration's Hazard Communication Standard (29 C.F.R. 1910.1200).

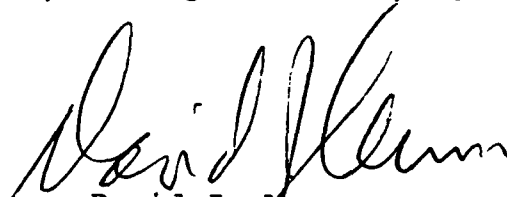
In the interest of economy and efficiency, DoD Components are advised not to develop or purchase any other basic hazard communication training program. Additional in-depth training on specific chemicals or operations is encouraged, however, and can be accomplished using commercial or component developed programs.

This publication applies to the Office of the Secretary of Defense, the Military Departments, the Organization of the Joint Chiefs of Staff, the Unified and Specified Commands, and the Defense Agencies. It is effective immediately.

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David J. Armor
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INTRODUCTION TO THIS GUIDE

This *Trainer's Guide* contains information to help you facilitate presentation of the Federal Hazard Communication Program in a group setting. As outlined below, this program consists of seven lessons. Each lesson includes one or two videotape segments designed for use with Application Exercises contained in the *Student Workbook* and this *Trainer's Guide*.

- Lesson 1: The Federal Hazard Communication Standard
(1 Videotape Segment, 1 Application Exercise)
- Lesson 2: Chemical Forms and Exposure Hazards
(2 Videotape Segments, 3 Application Exercises)
- Lesson 3: Types of Physical and Health Hazards
(2 Videotape Segments, 4 Application Exercises)
- Lesson 4: Controlling Chemical Hazards
(2 Videotape Segments, 2 Application Exercises)
- Lesson 5: Introduction to MSDSs and MSDS Physical Hazard Information
(2 Videotape Segments, 4 Application Exercises)
- Lesson 6: MSDS Health Hazard Information
(1 Videotape Segment, 2 Application Exercises)
- Lesson 7: Using Labels and The Hazardous Chemical Inventory
(1 Videotape Segment, 2 Application Exercises)

This is a multi-media training program. The videotape and workbook learning resources complement each other. Neither resource is intended to stand alone. The videotapes and *Student Workbook* together comprise a complete *SELF-STUDY* training program, which can be used for review purposes, or where classroom training is not feasible. In a class situation, this *Trainer's Guide* should be used to provide an opportunity for trainees to review and apply material presented in each videotape segment. Do this by making use of the following resources in this guide.

■ Application Exercises

One or two Application Exercise(s) follow each videotape segment. In the *Student Workbook*, answers and additional information appear on the back of each question page. In this guide, you'll find copies of the *Student Workbook* question pages for each Application Exercise on right-hand pages. On the left-hand page facing each *Student Workbook* question page, you'll find Trainer's Notes. These notes contain answers and additional information for each question taken from the answer pages of the *Student Workbook*, as well as information to help you present the questions and lead the class through the exercise(s).

Where two Application Exercises follow a videotape, the first exercise reinforces material that must be understood before questions presented in the second exercise can be answered.

■ Optional Questions

At the end of most Application Exercises in this *Trainer's Guide*, you will find optional questions. If time permits, you may wish to use these optional questions in addition to the preceding questions in the exercise. You can also use the optional questions to help tailor this training program to the needs of a particular class. Note that optional questions do not appear in the Student Workbook.

■ Lesson Summaries and Lesson Reviews

Each lesson concludes with a summary that highlights key material covered in the lesson. This *Trainer's Guide* contains a copy of the summary for each lesson that appears in the *Student Workbook*. On the facing Trainer's Notes pages, you'll find a Lesson Review. The Lesson Review contains a series of open-ended questions that you can use to review and highlight key material covered in the lesson.

In addition to suggestions for group application activities, this *Trainer's Guide* contains material you can use to introduce the course, each lesson, and each videotape segment. It also identifies appropriate places for drawing trainees' attention to specific pages of their *Student Workbook* and contains the following training resources.

- **SUMMARY** for each lesson identical to that contained in the *Student Workbook*.
- Review for each lesson that highlights key material in question/answer format
- Sample **MSDSs** identical to those contained in the *Student Workbook*
- Sample **WARNING LABELS** identical to those contained in the *Student Workbook*
- Sample **HAZARDOUS CHEMICAL INVENTORY** identical to that contained in the *Student Workbook*
- **GLOSSARY** of technical terms identical to that contained in the *Student Workbook*
- **MASTERS** (in the *Trainer's Guide* only) for making overheads for use in suggested classroom activities

As you will see, this is a rich course. The videotapes contain a great deal of important information. The opportunity for review, application, or discussion following each videotape segment will help trainees absorb this information more fully. Use the printed resources in this guide and the *Student Workbook* to provide this opportunity for your trainees.

HOW TO USE THIS TRAINER'S GUIDE

This *Trainer's Guide* contains specific suggestions for proceeding in a classroom situation. Follow along in this *Trainer's Guide* as you lead your class through the program. Begin by referring to pages I-1 through I-9 of this *Trainer's Guide* and orient the class by introducing this training program. Then, for each lesson, refer to this *Trainer's Guide* and do the following:

- 1) Introduce the Lesson — refer to the Lesson Introduction and Learning Objectives in this guide.
- 2) Introduce each videotape segment — refer to the Videotape Introduction in this guide and tell trainees what to watch for as they view the tape.
- 3) Show the videotape segment.
- 4) Answer any questions trainees may have after watching each videotape segment.
- 5) Following each videotape segment, engage students in an application activity. Do one or more of the following:
 - Lead the class through the associated Application Exercise(s) as a group activity. If you wish, trainees may follow along in their workbooks as you present the questions.
 - Refer trainees to the appropriate Application Exercise(s) in the *Student Workbook* and provide time to complete the exercise(e) either individually or in small groups.
 - Ask trainees to close their workbooks and lead the class through one or more of the Optional Questions suggested at the end of the associated Application Exercise(s) in this *Trainer's Guide*.
 - Draw trainees' attention to the Lesson Summary in their *Student Workbook* and quiz trainees on lesson objectives by asking the questions suggested in the appropriate section of the Lesson Review.
- 6) Either introduce the next videotape segment, or draw the trainees' attention to the Lesson Summary in their own copy of the *Student Workbook*.

Note: *As you use this guide, notice the following features:*

- *Student Workbook* pages appear on the right-hand pages of this guide. Trainer's Notes and Optional Questions appear on left-hand pages
- The lower-right corner of each right-hand page of this *Trainer's Guide* cross-references the *Student Workbook* either by telling you the *Student Workbook* page number, or by telling you that there is "No Reference." The latter occurs when the left-hand page of this *Trainer's Guide* contains information (e.g., Optional Questions) for which there is no corresponding information in the *Student Workbook*.
- Directions and notes are printed in italics, whereas material suitable for reading aloud in the classroom is printed in regular type.
- Square bullets, such as the ones you see here, are used to highlight key points and major topics covered in a lesson.

CLASS SCHEDULE

It is anticipated that this training program will take a minimum of four hours, including a short break. The approximate times for each lesson are shown below.

Time for group activities can be extended to permit more time for practice using MSDSs, or to cover specific chemical hazards to which your trainees may be exposed.

- Program Introduction and Lesson 1: approximately 30 minutes
- Lesson 2: approximately 35 minutes
- Lesson 3: approximately 30 minutes
- Lesson 4: approximately 30 minutes
- Lesson 5: approximately 35 minutes
- Lesson 6: approximately 30 minutes
- Lesson 7 and Program Wrap-Up: approximately 25 minutes

SEQUENCE OF LEARNING ACTIVITIES

Introduction Welcome, attendance/roster, class schedule, course overview

Lesson 1 Introduce Lesson 1: The Federal Hazard Communication Standard

Introduce and show Videotape Segment 1: The Federal Hazard Communication Training Program

Application Exercise 1

Lesson 1 Review and Summary

Present facility-specific information:

- **How to obtain MSDSs**
- **Location and availability of Hazardous Chemical Inventory and written Hazard Communication Program**
- **Training on specific chemical hazards**

Lesson 2 Introduce Lesson 2: Chemical Forms and Exposure Hazards

Introduce and show Videotape Segment 2A: Chemical Forms

Application Exercises 2A-1 and 2A-2

Introduce and Show Videotape Segment 2B: Routes of Exposure

Application Exercise 2B

Lesson 2 Review and Summary

Lesson 3 Introduce Lesson 3: Types of Physical and Health Hazards

Introduce and show Videotape Segment 3A: Types of Physical Hazards

Application Exercises 3A-1 and 3A-2

Introduce and show Videotape Segment 3B: Types of Health Hazards

Application Exercises 3B-1 and 3B-2

Lesson 3 Review and Summary

B R E A K

- Lesson 4** **Introduce Lesson 4: Controlling Chemical Hazards**
- Introduce and show Videotape Segment 4A: Engineering Controls and Personal Protective Equipment
- Application Exercise 4A
- Introduce and show Videotape Segment 4B: Administrative Controls
- Application Exercise 4B
- Lesson 4 Review and Summary
- Lesson 5** **Introduce Lesson 5: Introduction to MSDSs and MSDS Physical Hazard Information**
- Introduce and show Videotape Segment 5A: Physical Characteristics Information
- Application Exercises 5A-1 and 5A-2
- Introduce and show Videotape Segment 5B: Physical Hazard Information
- Application Exercises 5B-1 and 5B-2
- Lesson 5 Review and Summary
- Lesson 6** **Introduce Lesson 6: MSDS Health Hazard Information**
- Introduce and show Videotape Segment 6: Health Hazard Information
- Application Exercises 6-1 and 6-2
- Lesson 6 Review and Summary
- Lesson 7** **Introduce Lesson 7: Using Labels and the Hazardous Chemical Inventory**
- Introduce and show Videotape Segment 7: Using Labels and the Hazardous Chemical Inventory
- Application Exercises 7-1 and 7-2
- Lesson 7 Review and Summary
- Training Program Wrap-Up

HOW TO PROCEED

Before attempting to lead the course in a classroom setting, take it yourself as a self-study using the *Student Workbook* in conjunction with this *Trainer's Guide*. Make sure you are thoroughly familiar with all the course materials. If you are not a subject-matter expert, make sure you know the name of the person(s) at your facility who can respond to questions you may be unable to answer for your class.

Note: *Occupational safety and health is a complex subject. No one can be expected to have all the answers in his or her head. Don't be embarrassed to say "I don't know" if someone asks a question that you can't answer, or if you're unsure of the answer — but do make sure that you know where to go for answers. Refer trainees to the person responsible for safety and health at your facility, or follow through yourself. Promise to get the answer for your trainee(s), make a note of the question, consult an expert to get the answer, and communicate the answer(s) to your trainee(s).*

As you proceed through this program yourself, read the material for each lesson contained in this *Trainer's Guide* and decide how you want to conduct your class. Consider the following options:

- Which Application Exercises in the *Student Workbook*, if any, do I want trainees to complete individually or in groups?
 - Which question(s) in this *Trainer's Guide* will I ask to stimulate classroom discussion?
 - What additional information, if any, should be presented about the chemical hazards or hazard communication program at our facility?
-

Note: *When giving this course, remember that the Application Exercises are NOT intended as tests. Instead, view them as resources to help trainees identify key information and learn how to put this information to work. Ask them to answer the selected questions as best they can. Stress the additional information given with the answers. Doing so will help trainees get the most out of this course.*

In addition to planning how you will cover each lesson, make sure that the following has been done:

- ___ A copy of Facility/Agency-specific Information Sheet (see page TG-9) is completed *prior to training session*.
- ___ Training program schedule completed
- ___ Attendance sheets prepared for trainees' signatures
- ___ Trainees and their supervisors informed of time and location of training program
- ___ Training room reserved
- ___ All required training program materials available

COURSE MATERIALS AND RESOURCES

To conduct your training program, you will need the following materials and resources:

- ___ *This Trainer's Guide*
- ___ Videotape 1 — contains segments 1 to 4A
- ___ Videotape 2 — contains segments 4B to 7
- ___ *Note: When VHS or BETA videotapes are used, all seven segments will be included on ONE tape.*
- ___ Videotape player and monitor(s) or projection screen to permit viewing by all trainees
- ___ Copy of the *Student Workbook* for yourself and each trainee
- ___ Training Program Schedule for distribution to trainees
- ___ Chalkboard, whiteboard, flip chart, and/or overhead projector for use in group activities
- ___ Contact who can answer questions not covered in this training program
- ___ (Optional) Copy of MSDSs, warning labels, and the Hazardous Chemical Inventory for your facility

**FEDERAL HAZARD COMMUNICATION TRAINING PROGRAM
FACILITY/AGENCY-SPECIFIC INFORMATION**

[To be filled out before the training session]

Facility

- Name:
- Location:

Safety Industrial Hygiene, and Occupational Health Office(s)

- Location:
- Telephone number:
- Location:
- Telephone number:
- Location:
- Telephone number:

Material Safety Data Sheets

- Location:
- Telephone number:
- How to obtain copies:

Hazardous Chemical Inventory

- Location:
- Telephone number:

Facility Hazard Communication Program

- Location:

Emergency Telephone Numbers

- Spill:
- Leak:
- Fire:
- First aid:

COURSE INTRODUCTION

TRAINER'S NOTES: Course Introduction

Note: *From this point in the Trainer's Guide, right-hand pages are reserved for information contained in the Student Workbook.*

To orient students and introduce the course, make the following points.

- The Federal government is working to reduce injury and illness caused by chemical materials in workplace.
- This is an opportunity for labor and management to work together in everyone's best interest.
- OSHA's Hazard Communication Standard, issued in 1983 and revised in 1987, protects employees' right to —
 - know about chemical materials they work with; and
 - learn how to work safely with these chemical materials.
- Executive Order 12196 of 1980 and 29 CFR Part 1960 provide the authority for implementing this Standard within the Federal sector.
- This training program was developed for federal government employees to provide the information and training needed to help protect them from hazardous chemical materials that may present health and safety risks on the job.
- Take this training program seriously and learn all that you can — your health and safety depend on it.

Course Overview

List lesson titles for trainees; refer to a handout of the class schedule that includes lesson titles, or invite trainees to look at the Overview that begins on page I-1 of their workbook.

COURSE INTRODUCTION

The Federal government is working to reduce the risk of injury or illness caused by hazardous chemicals in the workplace. Accomplishing this goal requires information and communication. Everyone needs to know about the hazardous chemicals they work with — whether the material poses a risk to safety or health, and how to minimize or eliminate any such risks.

The Hazard Communication Standard was issued by the Occupational Safety and Health Administration (OSHA) in 1983 and revised in 1987. Executive Order 12196 of 1980 and 29 CFR Part 1960 provide the authority for implementing this Standard within the Federal sector. The Hazard Communication Standard helps protect your right to work in a safe and healthful environment. It requires that you be:

- informed about hazardous chemicals in your workplace; and
- trained to work safely with these materials.

With respect to Federal civilian employees, this is an excellent opportunity for labor and management to work together in the presentation of the program. A joint effort will assure the success of the program because it involves the participation of everyone.

Working safely with chemical materials is a team effort. This workbook is part of a Federal training program designed to make you a knowledgeable member of the team. Your safety and health, as well as that of your co-workers, depends on your active participation in this program.

Learn about chemical materials, what forms they take, what safety and health risks they present, how they can enter your body and affect your health. Learn to recognize hazards, and learn how to control these hazards. Then, put your learning to work and help make your workplace safer and more healthful for everyone.

Course Overview

This course consists of the following seven lessons:

- Lesson 1: The Federal Hazard Communication Standard

This lesson introduces you to the Standard issued by OSHA, as it applies to the Federal agencies. Then it identifies the goals of the Hazard Communication Standard and describes each of the actions required.

STUDENT WORKBOOK PAGE: I-1

■ Lesson 2: Chemical Forms and Exposure Hazards

This lesson describes the forms that chemical materials can take. It helps you recognize potential sources of exposure to chemicals in the workplace. It also describes how chemicals can enter your body when exposure occurs.

■ Lesson 3: Types of Physical and Health Hazards

Chemical materials can present hazards, either to your physical safety or to your health. This lesson describes specific types of chemical hazards in each category and helps you understand the risks associated with each type.

■ Lesson 4: Controlling Chemical Hazards

This lesson introduces you to the ways in which chemical hazards can be controlled. It describes engineering/mechanical controls, types of personal protective equipment, and various administrative/procedural controls. Then it tells you about ways that you can detect uncontrolled chemical hazards in your workplace and what to do about them.

■ Lesson 5: Introduction to MSDSs and MSDS Physical Hazard Information

Material Safety Data Sheets (MSDSs) are required by law to identify chemical materials, describe important physical properties, report known hazards, and identify required controls. This lesson shows you how to use those sections of the MSDS that identify chemical materials, physical properties, physical hazards, ways of controlling physical hazards, and correct procedures to follow if a fire, spill, or leak occurs.

■ Lesson 6: MSDS Health Hazard Information

This lesson shows you how to use information on the MSDS that describes health hazards and protective equipment required to guard against exposure to these health hazards. It also covers special precautions given on the MSDS, such as correct procedures for handling and storing the material safely.

■ Lesson 7: Using Labels and The Hazardous Chemical Inventory

The Hazard Communication Standard requires every workplace to use warning labels and maintain a Hazardous Chemical Inventory. This lesson identifies the information that these resources must contain and shows you how to use these documents to help protect yourself from chemical hazards.

Note: *Pages I-3 and I-4 of the Student Workbook contain information that is primarily of interest to trainees taking the course as a self-study. In a classroom situation, you can skip over these two pages of the Student Workbook and begin Lesson 1.*

Course Materials

Each lesson contains two types of resources: videotape and workbook. The videotape covers the lesson content. For each lesson, this workbook contains the following:

- *LESSON INTRODUCTION* — highlights what the lesson covers
- *LEARNING OBJECTIVES* — presents a checklist of statements describing what you should be able to do when you have completed the lesson
- *LEARNING RESOURCES* — identifies the specific videotape viewing segments and workbook exercises available to help you achieve the stated learning objectives
- *DIRECTIONS FOR PROCEEDING* — gives step-by-step instructions for taking the lesson as a self-study
- *VIDEOTAPE INTRODUCTIONS* — highlight what to look for when watching each videotape viewing segment; provide space to take notes
- *APPLICATION EXERCISES* — provide the opportunity to apply your videotape learning and to discover additional information
- *LESSON SUMMARY* — summarizes information presented in the lesson and serves as a job aide for quick review of key points

The Appendices in this workbook contain examples of the three documents covered in Lessons 5, 6, and 7: MSDSs (Appendix A), Warning Labels (Appendix B), and the Hazardous Chemical Inventory (Appendix C). Application Exercises in these three lessons provide practice using these documents. In addition, Appendix D contains a glossary of key technical terms introduced throughout the course. Refer to this glossary whenever you need to check the definition of a technical term.

How to Take This Course

If you are taking this course with an instructor in a classroom environment, the instructor will tell you how to proceed and guide you through the course.

If you are taking this course as a self-study, complete the lessons in numerical order. Begin each lesson by reading the introduction, learning objectives, and list of learning resources for the lesson in this workbook. Then follow the "Directions for Proceeding," which tell you the order in which you should complete the learning resources. If you wish, you may check off each learning resource as you complete it.

When taking this course, remember that the workbook application exercises are *NOT* intended as tests. Instead, view them as resources to help you identify key information and learn how to put this information to work. Answer all the questions as best you can, and then follow the instructions given for checking your answers. Make sure to read the additional information given with the answers. This will help you get the most out of this course.

If you wish, you can go back and review any videotape segment before proceeding to the next learning resource. Do this when you feel that you missed some important information, or might understand it better if you saw it again. For example, you might want to review a videotape segment if you have difficulty completing an associated application exercise, or if you find that you answered a number of the questions incorrectly.

Before proceeding from one lesson to the next, go back and review the stated learning objectives. Check off those you think you can do. If some remain unchecked, review the appropriate learning resource(s), or ask your course administrator for assistance.

LESSON 1: THE FEDERAL HAZARD COMMUNICATION STANDARD

TRAINER'S NOTES: Introduction and Learning Objectives

Note: *The Hazard Communication Standard (29 CFR Parts 1910, 1915, 1917, 1918, 1926, and 1928) is contained in the Federal Register, Vol. 52, No. 163, August 24, 1987.*

Ask trainees to look at the Introduction and Learning Objectives on page 1-1 of their Student Workbook and emphasize the following.

- Hazard Communication Standard was developed by OSHA — the Occupational Safety and Health Administration
- In this lesson, you'll see —
 - what OSHA does;
 - the basic goals of the Standard;
 - the actions required to help achieve these goals; and
 - which party or parties are responsible for carrying out each action.

TRAINER'S NOTES: Learning Resources

Videotape Segment 1, located on Tape 1.

LESSON 1: THE FEDERAL HAZARD COMMUNICATION STANDARD

INTRODUCTION

You have a right to work in a safe and healthful environment that is free from recognized chemical hazards. In 1983, the Occupational Safety and Health Administration (OSHA) issued the Hazard Communication Standard for manufacturing operations to help protect this right for you. In 1987, OSHA revised this standard and expanded the scope of the standard to include *ALL* workplaces where personnel are occupationally exposed to hazardous chemicals. This first lesson teaches you about the goals of this Standard and the actions it requires. You'll see how the Standard helps make sure that everyone —

- understands the hazards of chemicals they work with; and
- learns how to minimize these hazards.

LEARNING OBJECTIVES

When you have completed this lesson, you should be able to do the following:

- Identify the agency responsible for the Hazard Communication Standard and describe that agency's general responsibilities.
- List the goals of the Hazard Communication Standard.
- List the actions that the Hazard Communication Standard requires of chemical manufacturers, importers, management and employers.

LEARNING RESOURCES

- Videotape Segment 1: The Federal Hazard Communication Training Program
- Workbook Application Exercise 1: Finding Out About Chemical Hazards
- Lesson Summary

STUDENT WORKBOOK PAGE: 1-1

TRAINER'S NOTES: Directions for Proceeding

Note: *The "Directions for Proceeding" sections in the Student Workbook are intended primarily for trainees taking the course as a self-study. In a classroom situation, you can skip over these sections and proceed directly to the introduction of the video segment.*

TRAINER'S NOTES: Introduction to Videotape Segment 1

Note: *Ask trainees to look at the videotape introduction on page 1-2 of the Student Workbook and emphasize the following.*

- As we watch this videotape, you should learn —
 - how OSHA works on your behalf ;
 - the basic goals of the Hazard Communication Standard; and
 - the actions that the Standard requires of chemical manufacturers, importers, distributors, and employers.

DIRECTIONS FOR PROCEEDING

Complete the following steps in order. You might want to check off each step as you complete it.

- ☐ 1) Read the workbook introduction to Videotape Segment 1.
- ☐ 2) Watch Videotape Segment 1.
- ☐ 3) Complete Application Exercise 1 in this Workbook.
- ☐ 4) Read the Lesson 1 Summary in this Workbook

INTRODUCTION TO VIDEOTAPE SEGMENT 1: The Federal Hazard Communication Training Program

This videotape explains how the Occupational Safety and Health programs of the Federal government work in your behalf. The videotape helps you learn how the Hazard Communication Standard helps protect your right to work in a safe and healthful environment.

As you watch the tape, look for the goals of the Hazard Communication Standard. Also pay careful attention to the actions required of chemical manufacturers, importers, distributors, and employers, in your case, the Federal government.

If you wish, you may take notes on the following page as you watch.

Now, watch Videotape Segment 1.

STUDENT WORKBOOK PAGES: 1-2, 1-3

TRAINER'S NOTES: Sample Application Exercise

Answers in the Student Workbook always appear on the opposite side of the question page. In this Trainer's Guide, however, answers and additional information contained in the Student Workbook appear here. For example, the following is taken from page 1-6 of the Student Workbook. The question appears on page 1-5 of the Student Workbook.

Answer	Additional Information
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A B C	The Hazard Communication Standard requires that three documents be readily available to you for your everyday use: Hazard Warning Labels, Material Safety Data Sheets, and the Hazardous Chemical Inventory. With minor exceptions, the Standard also requires each facility to develop a local written program about how it will implement Hazard Communication.
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While your training is required under the Standard, there is no requirement for the use of textbooks.

Note: *If you want trainees to complete Application Exercises on their own and check their answers, direct them to page 1-5 in their workbook. Have trainees complete the Sample Application Exercise and check their answer by folding over the page and then reading the additional information on page 1-6. Answer any questions trainees may have about completing the Sample Application Exercise before directing trainees to complete Application Exercise 1. If you plan to proceed through the Application Exercises as a group discussion activity, direct trainees to disregard pages 1-5 and 1-6 of their workbook and proceed to page 1-7.*

SAMPLE APPLICATION EXERCISE

Directions: Check or circle your answer(s) to each question, or write your answer in the blank provided. When you complete the exercise, fold over the right side of the page to check your answers. Then turn the page to get more information about each question. Remember, some questions may have more than one answer.

Here is a sample question:

Which of the following documents are required by the Hazard Communication Standard?

- A) Hazard Warning Labels
 - B) Material Safety Data Sheets
 - C) Hazardous Chemical Inventory
 - D) Chemical textbooks for training you
-

Fold the right side of the page over to check the answer. Then turn the page and begin Application Exercise 1.

Answer

Additional Information

A B C

The Hazard Communication Standard requires that three documents be readily available to you for your everyday use: Hazard Warning Labels, Material Safety Data Sheets, and the Hazardous Chemical Inventory. With minor exceptions, the Standard also requires each facility to develop a local written program about how it will implement Hazard Communication.

While your training is required under the Standard, there is no requirement for the use of textbooks.

STUDENT WORKBOOK PAGE: 1-5, 1-6

TRAINER'S NOTES: Application Exercise 1

Ask trainees to turn to page 1-7 of their Student Workbook and either lead the class through Application Exercise 1 as a group activity, or provide time for students to complete the exercise individually or in small groups. The answers and additional information given below appear on pages 1-8 and 1-10 of the Student Workbook.

Answer	Additional Information
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- | | |
|----------|---|
| 1) A B | <p>Chemical manufacturers and importers must obtain or prepare an MSDS for every hazardous chemical material they sell. The MSDS identifies the hazards of the chemical and ways to control those hazards. This document must be provided to anyone who purchases the material. Employers must have an MSDS for every hazardous chemical they use.</p> <p>Manufacturers, importers, or distributors must ensure that each container of hazardous chemicals leaving the workplace is labeled, tagged, or marked with the identity of the material, all appropriate hazard warnings, and the name and address of the responsible party. The Hazardous Chemical Inventory is the responsibility of the end user.</p> |
| 2) B C D | <p>The Hazard Communication Standard requires every employer to:</p> <ul style="list-style-type: none">• Make MSDSs readily accessible to employees on all shifts, when they are in their work areas• Maintain an up-to-date Hazardous Chemical Inventory• Make sure that containers of chemical hazards in the workplace are labeled• Inform and train employees• Write a Hazard Communication Program |
| 3) C D | <p>The local written hazard communication program must contain at least the following:</p> <ul style="list-style-type: none">• Complete Hazardous Chemical Inventory• Plans for labeling and providing MSDSs (but not the actual labels or MSDSs)• Plans for informing and training employees |

APPLICATION EXERCISE 1: Finding Out About Chemical Hazards

Directions: Check or circle your answer(s) to each question, or write your answer in the blank provided. When you complete the exercise, fold over the right side of the page to check your answers. Then turn the page to get more information about each question. Remember, some questions may have more than one answer.

- 1) Which documents must chemical manufacturers and importers obtain or prepare?
 - A) MSDS (Material Safety Data Sheet)
 - B) Label
 - C) Hazardous Chemical Inventory

- 2) Which action(s) does the Hazard Communication Standard require *EVERY* employer to take?
 - A) Prepare MSDSs
 - B) Make MSDSs available on every shift
 - C) Maintain an inventory of hazardous chemicals
 - D) Make sure that containers of hazardous chemicals are labeled

- 3) What must the written Hazard Communication Program contain?
 - A) Copies of all MSDSs
 - B) Copies of all warning labels
 - C) Complete Hazardous Chemical Inventory
 - D) Plans for informing and training employees

Answer Additional Information

4) A B By law, you must be trained at the time of your first job assignment and whenever —

- a new hazard is introduced into your work area; or
- you are assigned to perform a non-routine task.

Simply being assigned to a new job does not require chemical hazard training. Additional training takes place only if you are being introduced to a new chemical hazard.

5) A B C D Your training on hazardous chemicals must cover the following:

- The Hazard Communication Standard itself and your rights under this law.
- The labeling system being used at your facility.
- The location and use of MSDSs.
- How to obtain all required written information.
- Where hazards in your work area exist and what those specific hazards are.
- Safe work practices, precautions, and equipment required to protect you.
- Correct procedures for handling emergency situations.
- Methods used to detect the presence or release of a hazardous chemical in your workplace.

Note: *Be sure to inform trainees that this training program does NOT cover all of the requirements listed above. For example, it does not cover specific hazards in each trainee's work area. Make sure trainees realize that additional training is generally needed to comply with the job-specific information and training requirements of the Hazard Communication Standard.*

Note: *Direct trainees either to proceed to the Lesson Summary when finished or to wait for further instructions. If time allows, ask the Optional Questions that begin on page 1-12 of this guide.*

- 4) When must you be trained about chemical hazards in your workplace?
- A) At the time of your first job assignment
 - B) Before a new hazard is introduced into your work area
 - C) When you change job assignments
- 5) What must your training on hazardous chemicals cover?
- A) The Hazard Communication Standard itself
 - B) Methods used to detect the presence or release of a hazardous chemical in your workplace
 - C) How to obtain and use MSDSs
 - D) How to protect yourself from chemical hazards
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Now go back to page 1-7, fold over the right side of the page, and check your answers. Look on the back of the question page for more information on each question. If you are taking this course as a self-study, proceed to the Lesson Summary when you have finished. If you are taking this course in a classroom situation, wait for further instructions from your trainer when finished.

TRAINER'S OPTIONAL QUESTIONS: Application Exercise 1

O1) *List choices and ask:* What are the goals of the Hazard Communication Standard?

- A) Reduce the incidence of illness and injury caused by chemical hazards in the workplace.
- B) Identify and evaluate chemical hazards.
- C) Prevent the use of hazardous chemicals in the workplace.
- D) Communicate information about chemical hazards to both employers and employees.

Answer: A, B, D

The Hazard Communication Standard was developed to:

- Reduce the incidence of illness and injury caused by chemical hazards
- Identify and evaluate chemical hazards
- Communicate information about chemical hazards to management and workers.

OSHA requires employers — in this case, the Federal Government — to take specific actions related to these goals, but the Standard itself does not provide a detailed action plan. Instead, each facility must develop its own written program.

The Standard does *NOT* strive to prevent the use of hazardous chemicals in the workplace. Such a goal is unrealistic. Chemical materials are needed in the workplace, just as they are at home.

STUDENT WORKBOOK: No Reference

O2) *List choices and ask:* Which chemicals are hazardous?

- A) Liquids that ignite easily
- B) Dust that may cause a skin rash
- C) Anything that smells bad!
- D) Explosive materials

Answer: A, B, D

Chemical hazards are materials that can cause health problems, fires, explosions, or any other type of dangerous situation.

Smelling bad makes a chemical unpleasant to work with. However, not all bad smelling materials are hazardous. In fact, some people like the smell of gasoline, but inhaling this material may be harmful to your health.

O3) *List choices and ask:* The standard gives you the right to review a copy of which of these documents?

- A) MSDSs for chemicals in your work area
- B) Warning labels
- C) The Hazardous Chemical Inventory
- D) The local written Hazard Communication Program

Answer: A, C, D

Under the Standard, employers must ensure that the required MSDS information is provided for each hazardous chemical and is readily accessible during each workshift to employees when they are in their work areas. The Standard also gives employees the right to inspect the Hazardous Chemical Inventory at any time during their shift, and to review the local written Hazard Communication Program.

Warning labels must be placed on containers of hazardous chemicals. Copies need not be made.

STUDENT WORKBOOK: No References

TRAINER'S NOTES: Lesson 1 Review

If time permits, review and reinforce learning objectives by asking the following open-ended questions answered in the Summary on the next page. Draw attention to the Summary for future reference.

Q1) What federal agency is responsible for the Federal Hazard Communication Standard?

Answer: OSHA, the Occupational Safety and Health Administration, issued the Hazard Communication Standard in 1983, and expanded its scope in 1987.

Q2) What are the basic goals of the Hazard Communication Standard?

Answer: This Standard strives to achieve the following goals:

1. Reduce the incidence of injury and illness caused by hazardous chemicals in the workplace.
2. Identify and evaluate chemical hazards.
3. Establish uniform requirements for communicating information about chemical hazards to both management and workers.

Q3) What are the basic actions required of chemical manufacturers and importers?

Answer: This Hazard Communication Standard requires chemical manufacturers and importers to do the following:

1. Conduct hazard determinations to identify the hazards of, and appropriate control measures for the chemicals they produce or import.
2. Label all containers of hazardous chemicals leaving the workplace to communicate the identity of the material, all appropriate hazard warnings, and the name and address of the responsible party.
3. Obtain or prepare an accurate and up-to-date MSDS for each hazardous chemical material sold and provide a copy to every employer that purchases the chemical.
4. Add new information to the MSDS on the hazards of a chemical and/or appropriate control measures within three months after becoming aware of such information.

LESSON 1 SUMMARY

The Hazard Communication Standard was issued in 1983 and revised in 1987 by the Occupational Safety and Health Administration (OSHA). This Standard strives to achieve the following goals:

1. Reduce the incidence of injury and illness caused by hazardous chemicals in the workplace.
2. Identify and evaluate chemical hazards.
3. Establish uniform requirements for communicating information about chemical hazards to both management and workers.

To achieve these goals, the Standard requires certain actions. First, chemical manufacturers and importers must:

1. Conduct hazard determinations to identify the hazards of, and appropriate control measures for the chemicals they produce or import.
2. Label all containers of hazardous chemicals leaving the workplace to communicate the identity of the material, all appropriate hazard warnings, and the name and address of the responsible party.
3. Obtain or prepare an accurate and up-to-date MSDS for each hazardous chemical material sold and provide a copy to every employer that purchases the chemical.
4. Add new information to the MSDS on the hazards of a chemical, and/or appropriate control measures within three months after becoming aware of such information.

The Standard also requires employers to do the following:

- Maintain an MSDS for every hazardous chemical used and make these MSDSs readily available to workers on every shift.
- Make sure that containers of hazardous chemicals are labeled, tagged, or otherwise marked to identify the chemical and warn workers of the hazards it presents.
- Maintain an up-to-date list of all hazardous chemical materials known to be present in the workplace and make this list readily available to workers at all times.
- Inform and train workers.
- Maintain a written local Hazard Communication Program that describes how the organization complies with the above actions and make this written program available to employees upon request.

STUDENT WORKBOOK PAGE: 1-11

Q4) What are the basic actions required of all facilities?

Answer: The Standard requires employers to do the following:

1. Maintain an MSDS for every hazardous chemical used and make these MSDSs readily available to workers on every shift.
2. Make sure that containers of hazardous chemicals are labeled, tagged, or otherwise marked to identify the chemical and warn workers of the hazards they present.
3. Maintain an up-to-date list of all hazardous chemical materials known to be present in the workplace and make this list readily available to workers at all times.
4. Inform and train workers.
5. Maintain a written a local Hazard Communication Program that describes how the operating unit complies with the above actions and make this written program available to employees upon request.

LESSON 2: CHEMICAL FORMS AND EXPOSURE HAZARDS

TRAINER'S NOTES: Introduction and Learning Objectives

Ask trainees to look at the Introduction and Learning Objectives on page 2-1 of their Student Workbook and emphasize the following:

- We saw in Lesson 1 how the Standard helps protect people by communicating information about chemical hazards in the workplace.
- In this lesson, you'll see —
 - what forms chemical materials take;
 - how and where chemical materials get into the air;
 - how chemical materials can enter your body; and
 - what factors affect the degree of hazard or risk associated with exposure to health hazards.

LESSON 2: CHEMICAL FORMS AND EXPOSURE HAZARDS

INTRODUCTION

Many work processes require the use of hazardous chemicals. Having a safe and healthful work environment means that you must recognize potential chemical hazards and protect yourself from them. In this lesson you will see what forms chemicals take, and how chemicals can enter your body.

LEARNING OBJECTIVES

When you have completed this lesson, you should be able to do the following:

- ☐ Define physical hazards and health hazards.
- ☐ Identify the forms that chemicals take.
- ☐ Describe how liquids and solids become airborne.
- ☐ Identify sources of mists, vapors, dusts, and fumes in the workplace.
- ☐ List and describe the major routes of exposure for health hazards.
- ☐ Identify factors that affect the degree of hazard associated with exposure to health hazards.
- ☐ List the categories of chemicals not included in the Hazard Communication Standard.

TRAINER'S NOTES: Learning Resources

Videotape Segments 2A and 2B, located on Tape 1

TRAINER'S NOTES: Directions for Proceeding

Direct trainees to disregard Student Workbook page 2-2 and to proceed to page 2-3 in the Workbook.

LEARNING RESOURCES

- Videotape Segment 2A: Chemical Forms
- Workbook Application Exercise 2A-1: Recognizing Chemical Hazards
- Workbook Application Exercise 2A-2: Identifying Sources of Airborne Hazards
- Videotape Segment 2B: Exposure Routes and Degree of Hazard
- Workbook Application Exercise 2B: Routes of Exposure
- Lesson Summary

DIRECTIONS FOR PROCEEDING

Complete the following steps in order. You might want to check off each step as you complete it.

- ___ 1) Read the workbook introduction to Videotape Segment 2A.
- ___ 2) Watch Videotape Segment 2A.
- ___ 3) Complete Application Exercise 2A-1 in this workbook.
- ___ 4) Complete Application Exercise 2A-2 in this workbook.
- ___ 5) Read the workbook introduction to Videotape Segment 2B.
- ___ 6) Watch Videotape Segment 2B.
- ___ 7) Complete Application Exercise 2B in this workbook.
- ___ 8) Read the lesson summary.

TRAINER'S NOTES: Introduction to Videotape Segment 2A

Emphasize that the Standard covers the majority of chemical hazards in the workplace. Then refer trainees to page 2-3 of their Student Workbook and briefly mention categories of chemical hazards not covered by the Standard.

■ Hazardous wastes regulated by the Environmental Protection Agency (EPA)

Example: contaminated soils and waste solvents covered under EPA regulations.

■ Tobacco and tobacco products

Example: cigarettes

■ Wood and wood products

Example: lumber, paper

■ Manufactured articles with a specific shape or design, and an end-use function dependent on that shape or design — provided that such articles do not release or cause exposure to a chemical hazard under normal conditions of use.

Example: chairs, phonograph records, styrofoam cups

■ Food, drugs, and cosmetics intended for personal consumption by employees while in the workplace.

Example: candy bars, aspirin, lipstick

■ As we watch this videotape, you should learn —

- to distinguish between physical hazards and health hazards;
- to identify solids, liquids, and gases; and
- to recognize how and where solids and liquids get into the air as mists, vapors, dusts, and fumes.

INTRODUCTION TO VIDEOTAPE SEGMENT 2A: Chemical Forms

In Lesson 1, you saw that the Hazard Communication Standard helps protect your right to work in a safe and healthful environment. The Standard does this by requiring actions that contribute to the recognition, evaluation, and control of chemical hazards in the workplace. The Standard includes most chemical hazards, but not all. For example, the following are not covered:

- Hazardous wastes regulated by the Environmental Protection Agency (EPA)

Example: contaminated soils and waste solvents covered under EPA regulations

- Tobacco and tobacco products

Example: cigarettes

- Wood and wood products

Example: lumber, paper

- Manufactured articles with a specific shape or design, and an end-use function dependent on that shape or design — provided that such articles do not release or cause exposure to a chemical hazard under normal conditions of use.

Example: chairs, phonograph records, styrofoam cups

- Food, drugs, and cosmetics intended for personal consumption by employees while in the workplace.

Example: candy bars, aspirin, lipstick

As you watch this videotape segment, look for the many types of chemical hazards the Standard *DOES* cover.

Learn to distinguish between physical hazards and health hazards. Also notice the forms chemicals can take, and the ways that chemical hazards get into the air.

If you wish, you may take notes on the following pages as you watch the tape.

Now, watch Videotape Segment 2A.

STUDENT WORKBOOK PAGE: 2-3

TRAINER'S NOTES: Application Exercise 2A-1

Ask trainees to turn to page 2-5 of their Student Workbook. Either lead the class through Application Exercise 2A-1 as a group activity, or provide time for students to complete the exercise individually or in small groups. The answers and additional information given below appear on pages 2-6 and 2-8 of the Student Workbook.

Answer	Additional Information
1) B D	<p>HEALTH HAZARDS can cause illness or injury when you are exposed to hazardous chemicals by breathing, swallowing, skin contact, or eye contact.</p> <p>Irritants can cause injury to whatever part of your body they contact — e.g., skin, eyes, lungs.</p> <p>Repeated skin contact with igniting explosives or flammable liquids, such as gasoline, can cause skin irritation. Breathing the vapors slows down the central nervous system. Asphyxiants cause suffocation by displacing oxygen in the air.</p>
2) A B C D	<p>Chemicals that are PHYSICAL HAZARDS can cause explosions, fires, violent chemical reactions, or other hazardous situations.</p> <p>All compressed gases present a physical hazard because they contain stored energy which can turn the gas cylinder into a powerful rocket.</p> <p>Some substances are water-reactive and create a hazardous chemical reaction when mixed with water (water-reactive).</p> <p>Spontaneously combustible chemicals present a fire hazard.</p> <p>Corrosives can cause a dangerous situation by eating through metals and other materials. They also present a HEALTH hazard because they can eat away body tissues, causing burns.</p>
3) Note:	<p><i>You may wish to use the master in the back of this book (Appendix E, page E-2) to make an overhead of the label, or write the caution statement on the chalkboard.</i></p>
A B	<p>Many chemicals are both physical and health hazards. This label warns you of a physical hazard (flammability) by telling you not to use the chemical near fire or flame. It warns you of a health hazard by telling you that the chemical is harmful when it enters your body — i.e., when swallowed, inhaled, or absorbed through the skin.</p>

APPLICATION EXERCISE 2A-1: Recognizing Chemical Hazards

Directions: Check or circle your answer(s) to each question, or write your answer in the blank provided. When you complete the exercise, fold over the right side of the page to check your answers. Then turn the page to get more information about each question. Remember, there may be more than one answer.

- 1) Which of the following terms identify a **HEALTH** hazard associated with exposure to hazardous chemicals?
 - A) Explosives
 - B) Irritants
 - C) Flammable gases
 - D) Gasoline or asphyxiants

- 2) Which of the following terms describe a **PHYSICAL** hazard of a hazardous chemical?
 - A) Compressed gas
 - B) Water-reactive
 - C) Spontaneously combustible
 - D) Corrosive

- 3) The caution label on a can of insect killer reads:

DO NOT USE NEAR FIRE OR FLAME. HARMFUL IF SWALLOWED, INHALED, OR ABSORBED THROUGH SKIN.

What type of hazard(s) does this chemical present?

- A) Health
- B) Physical

Answer	Additional Information
4)	Chemical materials exist in one of three basic physical forms.
<u>(L)</u> Glue	<ul style="list-style-type: none"> • SOLIDS, such as plastic, hold their shape. Each small granular particle of scouring powder also holds its shape. • LIQUIDS take the shape of their container. Glue, water, and solvents are liquids. • GASES have no definite shape. They can be compressed, and they expand to fill containers. Air is an example of a gas that is everywhere.
<u>(L)</u> Solvent	
<u>(L)</u> Water	
<u>(G)</u> Air	
<u>(S)</u> Scouring powder	
<u>(S)</u> Plastic	
5) A B C	Chemicals in ALL physical forms can become airborne. ANY airborne chemical can be inhaled.
	<ul style="list-style-type: none"> • Solids become airborne as fumes or dusts. • Liquids become airborne as mists or vapors • Gases become airborne if not contained

Note: *Direct trainees either to proceed to Application Exercise 2A-2 when finished or to wait for further instructions. If time allows, ask the Optional Questions that begin on page 2-12 of this guide.*

4) Classify each substance as either a SOLID (S), a LIQUID (L), or a GAS (G).

_____ Glue

_____ Solvent

_____ Water

_____ Air

_____ Scouring powder

_____ Plastic

5) Which state of chemical can become airborne and inhaled in the workplace?

A) Solid

B) Liquid

C) Gas

Now go back to page 2-5, fold over the right side of the page, and check your answers. Look on the back of the question page for more information on each question. If you are taking this course as a self-study, continue to Application Exercise 2A-2, "Identifying Sources of Airborne Hazards." If you are taking this course in a classroom situation, wait for further instructions from your trainer when finished.

TRAINER'S OPTIONAL QUESTIONS: Exercise 2A-1

O1) *List choices and ask:* Which type of chemical can expand to fill a room?

- A) Solid
- B) Liquid
- C) Gas

Answer: C

All gases expand to fill their container. The "container" can be a cylinder, a confined space, or an entire room.

O2) What are the two airborne forms of liquids?

Answer: Mist, Vapor

Liquids can become airborne as mists and vapors.

O3) What are the two airborne forms of solids?

Answer: Dust, Fume

Solids can become airborne as dusts or fumes.

STUDENT WORKBOOK: No Reference

TRAINER'S NOTES: Application Exercise 2A-2

Ask trainees to turn to page 2-9 of their Student Workbook and either lead the class through Application Exercise 2A-2 as a group activity, or provide time for students to complete the exercise individually or in small groups. The answers and additional information given below appear on page 2-10 of the Student Workbook.

Answer	Additional Information
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1) A D

All airborne hazards —

- spread out from their source; and
- enter the body through breathing.

Not all airborne hazards settle quickly. Larger mist droplets and solid particles tend to settle, whereas smaller, lighter ones often remain airborne.

Most airborne hazards are NOT easily seen or smelled. Many are invisible and have no odor. The amount of airborne chemical that is hazardous to your health when inhaled may be too small for you to see or smell.

You may wish to list the following choices on the chalkboard before you ask questions 2, 3, and 4.

A) Dust B) Fume C) Vapor D) Mist E) Gas

2) C

Vapors form above any exposed liquid surface.

When a container of liquid is opened or leaks, a vapor is formed. Most liquid transfer operations produce vapors.

3) A

Dust (tiny solid particles) becomes airborne during mechanical operations like grinding, crushing, pulverizing, and abrasive cleaning.

Transfer of granular, fibrous, or powdered solids such as cement mix or asbestos, also produces dust.

Solids become airborne as fumes as well, but mechanical operations don't produce fumes. Fumes form when solids are melted.

APPLICATION EXERCISE 2A-2:
Identifying Sources of Airborne Hazards

Directions: Check or circle your answer(s) to each question, or write your answer in the blank provided. When you complete the exercise, fold over the right side of the page to check your answers. Then turn the page to get more information about each question.

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- 1) Which properties are common to all airborne hazards?
- A) Spread out from the source
 - B) Settle quickly
 - C) Easily seen and smelled
 - D) Normally enter the body through breathing
- 2) What type of airborne hazard probably forms when a solvent such as gasoline is transferred from a drum to a can?
- A) Dust B) Fume C) Vapor D) Mist E) Gas
- 3) What type of airborne hazard probably results from grinding clean, dry metal parts?
- A) Dust B) Fume C) Vapor D) Mist E) Gas

Answer Additional Information**4) A B E**

Smoke is a mixture of fire gases and tiny airborne dust or fume particles.

The fire which produced the smoke can also produce vapors and mists, although these are not part of the smoke itself.

Note: *Direct trainees either to read the Introduction to Videotape Segment 2B when finished or to wait for further instructions. If time allows, ask the Optional questions that begin on page 2-18 of this guide.*

4) Which airborne hazard(s) is (are) present in smoke?

A) Dust

B) Fume

C) Vapor

D) Mist

E) Gas

Now fold over the right side of the page, and check your answers. Look on the back of the question page for more information on each question. If you are taking this course as a self-study, proceed to the Lesson Summary when you have finished. If you are taking this course in a classroom situation, wait for further instructions from your trainer when finished.

TRAINER'S OPTIONAL QUESTIONS: Application Exercise 2A-2

List the following choices on the chalkboard and ask questions O1 and O2.

- A) Dust B) Fume C) Vapor D) Mist E) Gas
-

- O1)** What type of airborne hazard probably forms when liquid chemicals are mixed in an open agitator?

Answer: C, D; Vapor, Mist

Vapors form above any exposed liquid surface. Liquids form mists (tiny airborne droplets) when sprayed, bubbled, or stirred (agitated). Mists are often formed in spraying operations.

Mists also form when liquid vapors condense. This happens when coolants or lubricants are applied to hot surfaces.

- O2)** What type of airborne hazard probably forms when metal parts are welded together?

Answer: B; Fume

Fumes form when a solid is melted. Welding, soldering, casting, and brazing produce fumes. (Ozone and nitrous oxide are examples of gases created from arc welding.)

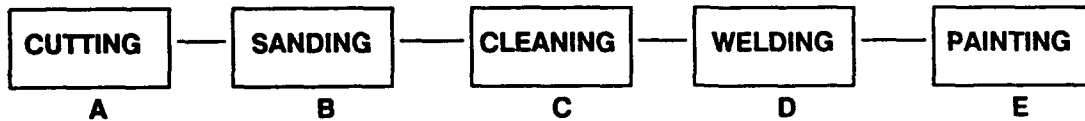
Vapors rise from the surface of the liquid melt in these processes. When the vapors cool, they solidify to form tiny airborne fume particles.

Use the master provided in back of this book (Appendix E, page E-3) to make an overhead of the chart on page 2-18, or draw this chart on the chalkboard. Describe the chart. Then ask questions O3 through O6, which are based on the chart.

Tell trainees: Look at this flow diagram for an autobody repair process. First, the damaged part is removed with a cutting torch. The surrounding area is then sanded to remove old paint and cleaned with a solvent that removes oil and road film. The new part is then welded in place with an acetylene torch and finally, the part is spray painted.

STUDENT WORKBOOK: No Reference

TRAINER'S OPTIONAL QUESTIONS: Application Exercise 2A-2 Continued



O3) Which step or steps produce *DUST*?

Answer: B; Sanding

Paint *DUST* (tiny airborne particles) is formed during the sanding operation.

O4) Which step or steps produce *FUMES*?

Answer: A, D; Cutting, Welding

FUMES are formed when a solid is melted — when the old part is cut off with a torch, and when the new part is welded in place.

O5) Which step or steps produce *MISTS* or *VAPORS*?

Answer: C, E; Cleaning, Painting

A *MIST* or *VAPOR* is formed when liquids are applied and when liquids are removed in drying operations. The liquid cleaner produces vapor as it evaporates. Spray painting produces both mists and vapors.

O6) Which step or steps produce *SMOKE*?

Answer: A; Cutting

Combustion produces *SMOKE*, which is a mixture of hot fire gases and tiny airborne dust or fume particles. Cutting produces smoke from combustion of the autobody paint. Welding produces smoke when parts are coated with paint or oil, but not when parts are clean.

STUDENT WORKBOOK: No Reference

TRAINER'S OPTIONAL QUESTIONS: Application Exercise 2A-2 Continued

- O7)** Use the master provided in the back of this book (Appendix E, page E-4) to prepare an overhead of the following matrix and complete it as a group activity. You may also make a handout and invite trainees to complete the matrix as the discussion proceeds.

Tell trainees: The table below lists various operations which produce airborne hazards. Across the top are the forms airborne hazards can take: Dust, smoke, fume, vapor, mist and gas. Let's check off all the airborne hazards each process can produce. For example, welding can produce smoke, fume and gases.

For each listed process, ask: Which hazards can _____ produce?

	DUST	SMOKE	FUME	VAPOR	MIST	GAS
WELDING		X	X			X
SPRAY PAINTING						
GRINDING						
BRUSH PAINTING						
SANDING						
SWEEPING						
SOLDERING						
DEGREASING						
DIPPING						

Note: After completing the matrix, ask trainees to identify operations or tasks in your facility that are likely sources of dust, fumes, mists, vapors, or gases.

STUDENT WORKBOOK: No Reference

TRAINER'S OPTIONAL QUESTIONS: Application Exercise 2A-2 Continued**07) (Continued)****Answer:**

	DUST	SMOKE	FUME	VAPOR	MIST	GAS
WELDING		X	X			X
SPRAY PAINTING				X	X	
GRINDING	X					
BRUSH PAINTING				X		
SANDING	X					
SWEEPING	X					
SOLDERING		X	X			
DEGREASING				X	X	
DIPPING				X		

DUST is made up of tiny airborne particles formed as solids are broken up or when granular or powdered solids are transferred as in grinding, sanding, sweeping.

SMOKE is a mixture of fire gases and airborne dust or fume particles. It is found in processes involving combustion or burning such as welding and soldering.

FUME particles are formed by cooling vapors from operations where solids have been melted as in welding and soldering.

VAPORS form above any exposed liquid surface as the liquid evaporates. Both spray painting and brush painting apply liquid paint to a surface. Degreasing and dipping operations also involve exposed liquid surfaces.

MISTS are formed as liquids are agitated or sprayed under pressure, such as in spray painting.

GASES may be compressed for use in a particular operation such as welding or they may be a by-product of the process itself, as in starting engines.

STUDENT WORKBOOK: No Reference

TRAINER'S NOTES: Introduction to Videotape Segment 2B

Note: *Ask trainees to look at the videotape introduction on page 2-13 of the Student Workbook and emphasize the following.*

You've seen the forms chemicals can take. Now, let's see how these forms can enter your body.

■ As we watch this videotape, you should learn —

- to recognize the four exposure routes (inhalation, skin or eye contact, skin absorption, and ingestion); and
- to identify factors that affect the degree of hazard, or risk, associated with exposure to a health hazard.

INTRODUCTION TO VIDEOTAPE SEGMENT 2B: Routes of Exposure

Exposure routes are ways that chemicals enter the body. This videotape segment describes four routes of exposure.

- Breathing/Inhalation
- Skin and eye contact
- Skin absorption
- Swallowing/Ingestion

Also look for the factors that affect degree of hazard when you are exposed by one of these routes.

If you wish, you may take notes on the following page as you watch the tape. Now, watch Videotape Segment 2B.

TRAINER'S NOTES: Application Exercise 2B

Ask trainees to turn to page 2-15 of their Student Workbook and either lead the class through Application Exercise 2B as a group activity, or provide time for students to complete the exercise individually or in small groups. The answers and additional information given below appear on page 2-16 of the Student Workbook.

Answer	Additional Information
---------------	-------------------------------

- | | |
|--------------|--|
| 1) A B C (D) | <p>Ingested chemicals can enter the bloodstream from the intestines. Many inhaled chemicals can pass from the lungs into the bloodstream. Some chemicals enter the bloodstream by being absorbed through skin. Skin absorption cannot occur without skin contact, but skin absorption does not always follow skin contact.</p> <p>Once in the bloodstream, chemicals can affect any part of your body.</p> |
| 2) Note: | <p><i>As a group exercise, you may wish to list choices A-D on the chalkboard and ask, " Which exposure route is most likely to cause _____? " for each given symptom.</i></p> |
| D | <p>RED, IRRITATED SKIN. Skin contact hazards can cause anything from mild irritation and redness to severe burns.</p> |
| A B C | <p>DIFFICULTY IN BREATHING. Inhalation hazards can affect the respiratory system on contact, making it hard to breathe. Chemicals that enter the bloodstream through skin absorption or ingestion can also affect the respiratory system.</p> |
| B | <p>BURNED ESOPHAGUS. Chemicals that are ingested travel from the mouth, down the esophagus, and into the stomach. Damage can occur anywhere along this route.</p> |
| A B C | <p>HEADACHE, DIZZINESS. Headache and dizziness occur when some chemicals enter the bloodstream — whether by inhalation, ingestion, or skin absorption.</p> |

APPLICATION EXERCISE 2B:
Understanding How Chemicals Enter Your Body

Directions: Check or circle your answer(s) to each question, or write your answer in the blank provided. When you complete the exercise, fold over the right side of the page to check your answers. Then turn the page to get more information about each question.

1) How can chemicals in the workplace enter your bloodstream?

- A) Ingestion
- B) Inhalation
- C) Skin absorption
- D) Skin contact

2) Match the exposure route(s) to the effect most likely to appear immediately.

_____ Red, irritated skin

_____ Difficulty in breathing

_____ Burned esophagus

_____ Headache, dizziness

A) Inhalation

B) Ingestion

C) Skin absorption

D) Skin contact

Answer Additional Information

3) Harry The degree of hazard greatly depends on dosage —

- how *MUCH* you are exposed to each time;
- how *LONG* each exposure lasts; and
- how *OFTEN* you are exposed.

Harry's dosage is higher because he is exposed eight hours a day, five days a week. Joe does not weld all day every workday.

Note: *Direct trainees either to proceed to the Lesson Summary when finished or to wait for further instructions. If time allows, ask the Optional Questions that begin on page 2-32 of this guide.*

- 3) Joe welds occasionally as part of his job in a repair shop. Harry does the same kind of welding all day as part of his job. Is the degree of hazard higher for Joe or for Harry?
- _____

Now fold over the right side of the page, and check your answers. Look on the back of the question page for more information on each question. If you are taking this course as a self-study, proceed to the Lesson Summary when you have finished. If you are taking this course in a classroom situation, wait for further instructions from your trainer.

TRAINER'S OPTIONAL QUESTIONS: Application Exercise 2B

Use the master provided in back of this book (Appendix E, page E-5) to make an overhead or handout of the sketches for questions O1 through O3.

Ask trainees to identify the name of the potential exposure route(s) (ingestion, skin contact, skin absorption, inhalation) for each worker.

O1) *Point to the sketch below and ask: How could this worker be exposed?*



Answer: Inhalation

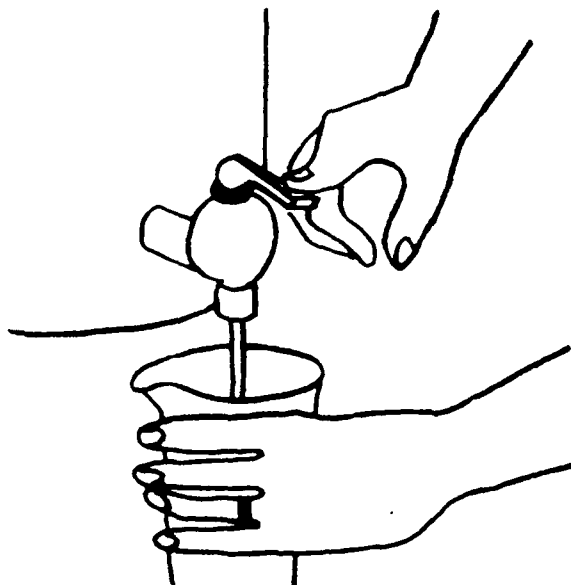
Airborne hazards enter the body through the nose or mouth when workers breathe. This is the most common exposure route, and often the most hazardous.

Inhaled chemicals travel from the mouth or nose, down the windpipe, and into the lungs. From the lungs, many chemicals enter the bloodstream.

Skin contact, skin absorption, and eye contact are not likely here because the working is wearing long gloves and goggles.

STUDENT WORKBOOK: No Reference

O2) *Point to the sketch below and ask: How could this worker be exposed?*



Answer: Skin contact/absorption

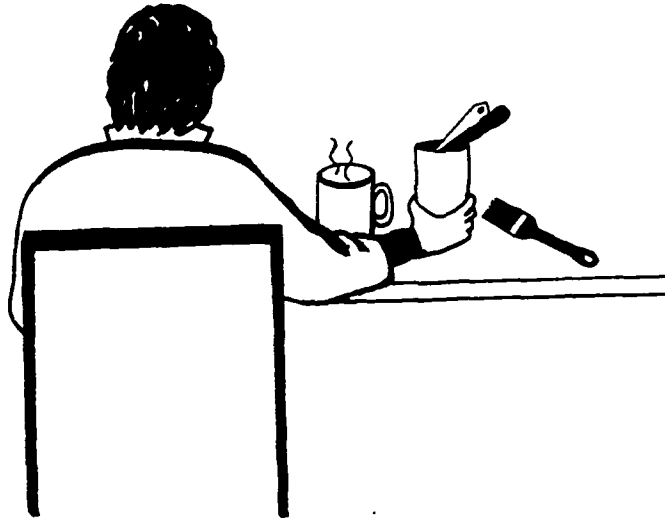
Getting chemicals on the hands, or any other part of the body, can damage the skin on contact. Repeated exposure to some skin contact, hazards can also cause dermatitis.

Skin absorption hazards pass through the skin on contact and enter the bloodstream.

A cut increases the risk of skin absorption. Chemicals that cannot enter the body through healthy skin can pass right through broken or damaged skin.

STUDENT WORKBOOK: No Reference

O3) *Point to the sketch below and ask:* How could this worker be exposed?



Answer: Ingestion

Chemicals that are swallowed travel from the mouth, down the esophagus, and into the stomach. From the stomach chemicals can enter the intestines and be absorbed into the bloodstream.

Practicing good personal hygiene, keeping food and drink out of work areas where chemical hazards exist, and being especially careful to label chemical containers can help prevent exposure by ingestion.

Although not likely, skin contact and absorption are possible, if the chemical is spilled. Likewise, inhalation of vapors is possible.

Because the absorptive area of the lungs is so large, the body is very vulnerable to damage through inhalation.

STUDENT WORKBOOK: No Reference

- O4)** *Tell trainees:* The internal surface area of the lungs is 750 to 1100 square feet.

Ask trainees: Which of the following is about 750 to 110 square feet in area?

- A) Top of a snack tray
- B) Top of a ping pong table
- C) Half a tennis court

Answer: C

The inside surface area of the lungs is 750 to 1100 square feet, about half the size of a tennis court! The total internal surface of the digestive tract is about 100 to 110 square feet. The skin totals about 20 to 22 square feet.

- O5)** *Tell trainees:* MEK (methyl ethyl ketone) dissolves paint and varnish. It is also a skin absorption hazard. Joe uses MEK to clean paint off his hands.

Ask trainees: Can the paint enter Joe's body?

Answer: Yes

Using solvents to clean hands or skin can carry other chemicals into the bloodstream.

Like MEK, many solvents are skin absorption hazards. Chemicals that would not normally pass through the skin can do so when dissolved in such solvents.

STUDENT WORKBOOK: No Reference

- O6)** *Tell trainees:* John and Bill work side by side performing the same job in a painting and coating operation. One day, for no apparent reason, John starts gasping for air. Bill remains fine.

List choices and ask trainees: Which of the following could explain what happened?

- A) John swallowed a toxic chemical.
- B) John inhaled paint vapor or mist.
- C) John developed a sensitivity to one of the chemicals in the paint.
- D) John started taking a new medication.

Answer: A, C, D

John may have accidentally swallowed some of a chemical. This would expose John, but not Bill.

It's also possible that John developed a sensitivity to one of the chemicals in the paint. This can happen any time after the first exposure to some chemicals. It can cause an allergic-like response such as a skin rash or trouble breathing.

Taking a new medication could also explain John's reaction. Exposure to two chemicals at the same time is often more serious than exposure to either chemical alone.

John could have been exposed by inhaling paint vapor or mist, but Bill would also have been exposed and, most likely, would also have reacted.

STUDENT WORKBOOK: No Reference

If time permits, review and reinforce learning objectives by asking the following open-ended questions answered in the Summary. After each question ask for specific examples from the trainees' work environment. Draw attention to the Summary for future reference.

Q1) What is a physical hazard?

Answer: *PHYSICAL HAZARDS* are chemicals that cause explosion, fires, violent chemical reactions, or other hazardous situations.

Q2) What is a health hazard?

Answer: *HEALTH HAZARDS* are chemicals that can cause illness or injury when inhaled or swallowed, or through contact with the skin or eyes.

Q3) What properties distinguish solids, liquids, and gases?

Answer: *SOLIDS* have a definite shape and can become airborne as dust or fume particles.

LIQUIDS take the shape of their container and can become airborne as mists or vapors.

GASES are easily compressed, expand to fill a container, and become airborne when not contained.

Q4) What are the airborne forms of a solid? How do solids become airborne?

Answer: Both *DUSTS* and *FUMES* are made up of tiny solid particles. Mechanical operations like grinding and crushing produce dust. So does transfer of powdered or fibrous solids and abrasive cleaning. Fumes form by vapor condensation when solids are melted in operations like welding and metal casting.

Q5) What are the airborne forms of a liquid? How do liquids become airborne?

Answer: *VAPORS* are formed above any exposed liquid surface. Heating a liquid makes it vaporize more quickly. *MIST* is made up of tiny droplets that become airborne when liquids are sprayed, agitated, or applied to a hot surface. Mists also form when hot vapors cool in air and condense.

LESSON 2 SUMMARY

The Hazard Communication Standard defines two main categories of chemical hazards:

- *PHYSICAL HAZARDS* are chemicals that cause explosion, fires, violent chemical reactions, or other hazardous situations.
- *HEALTH HAZARDS* are chemicals that can cause illness or injury when inhaled or swallowed, or through contact with the skin or eyes.

All chemicals exist in one of three basic forms:

- *SOLIDS* have a definite shape and can become airborne as dust or fume particles.
- *LIQUIDS* take the shape of their container and can become airborne as mists or vapors.
- *GASES* are easily compressed, expand to fill a container, and become airborne when not contained.

Both *DUSTS* and *FUMES* are made up of tiny solid particles. Mechanical operations like grinding and crushing produce dust. So does transfer of powdered or fibrous solids and abrasive cleaning. Fumes form by vapor condensation when solids are melted in operations like welding and metal casting.

VAPORS are formed above any exposed liquid surface. Heating a liquid makes it vaporize more quickly. *MIST* is made up of tiny droplets that become airborne when liquids are sprayed, agitated, or applied to a hot surface. Mists also form when hot vapors cool in air and condense.

Q1) What are the four exposure routes?

Answer: The four exposure routes are breathing/inhalation, skin/eye contact, skin absorption, and swallowing/ingestion.

Q2) What happens when you inhale a health hazard?

Answer: *BREATHING/INHALATION* takes a chemical from the nose or mouth, down the windpipe, and into the lungs. Some chemicals get trapped in the lungs. Others leave the lungs when one breathes out or exhales, but many pass from the lungs into the bloodstream.

Q3) What can happen when skin or eye contact occurs?

Answer: *SKIN/EYE CONTACT* can cause anything from reddening or itching to severe rashes, burns, loss of eyesight or even death.

Q4) What is the difference between skin contact and skin absorption?

Answer: *SKIN ABSORPTION* hazards pass through the skin on contact and enter the bloodstream. Once in the bloodstream, chemicals can spread throughout the body and cause injury or disease far away from the original site of contact. Chemicals can also be absorbed through the mucous membranes of the eye.

Q5) What happens when you swallow a chemical?

Answer: *SWALLOWING/INGESTION* takes a chemical from the mouth, down the esophagus, and into the stomach. From the stomach many chemicals enter the intestines, where they can be absorbed into the bloodstream and spread throughout the body. Damage can be done at any point along the way.

Exposure routes are ways that chemicals enter your body. There are four main routes of exposure:

- **BREATHING/INHALATION** takes a chemical from your nose or mouth, down your windpipe, and into your lungs. Some chemicals get trapped in your lungs. Others leave when you breathe out. But many pass from your lungs into your bloodstream.
- **SKIN/EYE CONTACT** can cause anything from reddening or itching to severe rashes, burns, loss of eyesight or even death.
- **SKIN ABSORPTION** hazards pass through the skin on contact and enter the bloodstream. Once in your bloodstream, chemicals can spread throughout your body and cause injury or disease far away from the original site of contact. Chemicals can also be absorbed through the mucous membranes of the eye.
- **SWALLOWING/INGESTION** takes a chemical from your mouth, down your esophagus, and into your stomach. From your stomach, many chemicals enter the intestines, where they can be absorbed into the bloodstream and spread throughout your body. Damage can be done at any point along the way.

Q6) What factors can affect the degree of hazard associated with exposure to a health hazard?

Answer: The *DEGREE OF HAZARD* associated with exposure to health hazards depends on the following.

■ **TOXICITY** of the chemical

Toxicity	Effects of Exposure
Low	Minor symptoms that go away when exposure stops
Medium	Require medical attention, may be permanent
High	Can cause death or severely disabling conditions

■ **EXPOSURE ROUTE**

Some chemicals are more toxic by one exposure route than by another. For example, onion juice vapor irritates the eyes, but skin contact with onion juice produces little or no effect.

■ **DOSAGE**, which depends on —

- How MUCH chemical each exposure involves;
- How LONG each exposure lasts; and
- How OFTEN exposure occurs.

■ **INDIVIDUAL DIFFERENCES**, such as the following:

- Work practices
- Age and size
- General physical and emotional health
- Allergies and sensitivities
- Level of exertion
- Combination of chemicals in the body, which depends on what medications a worker is taking and whether or not the worker smokes tobacco or drinks alcoholic beverages.

The *DEGREE OF HAZARD* associated with exposure to health hazards depends on the following.

- *TOXICITY* of the chemical

Toxicity	Effects of Exposure
Low	Minor symptoms that go away when exposure stops
Medium	Require medical attention, may be permanent
High	Can cause death or severely disabling conditions

- *EXPOSURE ROUTE*

Some chemicals are more toxic by one exposure route than by another. For example, onion juice vapor irritates the eyes, but skin contact with onion juice produces little or no effect.

- *DOSAGE*, which depends on —

- How *MUCH* you are exposed to each time;
- How *LONG* each exposure lasts; and
- How *OFTEN* you are exposed.

- *INDIVIDUAL DIFFERENCES*, such as the following:

- Work practices
- Age and size
- General physical and emotional health
- Allergies and sensitivities
- Level of exertion
- Combination of chemicals in the body, which depends on what medications you are taking and whether or not you smoke tobacco or drink alcoholic beverages.

LESSON 3: TYPES OF PHYSICAL AND HEALTH HAZARDS

TRAINER'S NOTES: Introduction and Learning Objectives

Ask trainees to look at the Introduction and Learning Objectives on page 3-1 of their Student Notebook and emphasize the following:

- In the preceding lesson you saw that the Hazard Communication Standard covers both physical hazards and health hazards. This lesson introduces you to the different types of hazards in each of these two categories. It helps you understand how each type of hazard can affect your health and safety.
- In this lesson, you'll see how to identify —
 - the basic types of physical hazards;
 - the different types of fire hazards;
 - two types of unstable/reactive chemicals; and
 - eight basic types of health hazards.

LESSON 3: TYPES OF PHYSICAL AND HEALTH HAZARDS

INTRODUCTION

In the preceding lesson, you saw that The Hazard Communication Standard covers both physical hazards and health hazards. This lesson introduces you to the different types of hazards in each of these two categories. It helps you understand how each type of hazard can affect your health and safety.

LEARNING OBJECTIVES

When you have completed this lesson, you should be able to do the following:

- ☐ Identify the basic types of physical hazards.
- ☐ List and define types of fire hazards.
- ☐ List and define two types of unstable/reactive chemicals.
- ☐ Identify eight basic types of health hazards.

TRAINER'S NOTES: Learning Resources

Videotape Segments 3A and 3B, located on Tape 1

TRAINER'S NOTES: Directions for Proceeding

Direct trainees to disregard page 3-2 of the Student Workbook and to proceed to page 3-3 of the Workbook.

LEARNING RESOURCES

- Videotape Segment 3A: Types of Physical Hazards
- Workbook Application Exercise 3A-1: Defining Physical Hazards
- Workbook Application Exercise 3A-2: DOs and DON'Ts
- Videotape Segment 3B: Types of Health Hazards
- Workbook Application Exercise 3B-1: Defining Health Hazards
- Workbook Application Exercise 3B-2: Recognizing Workplace Health Hazards
- Lesson Summary

DIRECTIONS FOR PROCEEDING

Complete the following steps in order. You might want to check off each step as you complete it.

- ___ 1) Read the workbook introduction to Videotape Segment 3A.
- ___ 2) Watch Videotape Segment 3A.
- ___ 3) Complete Application Exercise 3A-1 in this workbook.
- ___ 4) Complete Application Exercise 3A-2 in this workbook.
- ___ 5) Read the workbook introduction to Videotape Segment 3B.
- ___ 6) Watch Videotape Segment 3B.
- ___ 7) Complete Application Exercise 3B-1 in this workbook.
- ___ 8) Complete Application Exercise 3B-2 in this workbook.
- ___ 9) Read the lesson summary.

STUDENT WORKBOOK PAGE: 3-2

TRAINER'S NOTES: Introduction to Videotape Segment 3A

Note: *Ask trainees to look at the videotape introduction on page 3-3 of the Student Workbook and emphasize the following.*

Ask trainees to recall the definition of a physical hazard — chemicals that can cause explosion, fires, violent chemical reactions, or other hazardous situations. Emphasize the following.

- As we watch this videotape, you should learn to —
 - recognize the basic types of physical hazards and the safety risks each presents;
 - identify different types of fire hazards; and
 - recognize unstable or reactive chemicals.

INTRODUCTION TO VIDEOTAPE SEGMENT 3A: Types of Physical Hazards

Physical hazards are chemicals that can cause explosion, fires, violent chemical reactions, or other hazardous situations.

As you watch this videotape segment, learn to recognize the different types of physical hazards in the workplace. Notice how compressed gases, explosives, fire hazards, and unstable or reactive chemicals can affect your safety.

Now, watch Videotape Segment 3A.

STUDENT WORKBOOK PAGE: 3-3

TRAINER'S NOTES: Application Exercise 3A-1

Ask trainees to turn to page 3-5 of their Student Workbook. Either lead the class through Application Exercise 3A-1 as a group activity, or provide time for students to complete the exercise individually or in small groups. The answers and additional information given below appear on pages 3-6 and 3-8 of the Student Workbook.

Answer	Additional Information
---------------	-------------------------------

1)	The four basic types of <i>PHYSICAL</i> hazards are —
----	---

- compressed gases;
- explosives;
- fire hazards, including combustibles; and
- unstable or reactive chemicals.

2) Note:	<i>You may wish to list choices A to D on the chalkboard and ask, "What type of physical hazard _____?" for each description given.</i>
-----------------	---

B	Contains a lot of stored energy
---	---------------------------------

A	Ignites and burns easily
---	--------------------------

D	Causes a sudden release of pressure and heat
---	--

C	Causes a dangerous situation when mixed with other chemicals
---	--

Compressed gases contain a great deal of stored energy. They are physical hazards because the sudden release of this energy is dangerous. Explosives and reactive chemicals can cause a sudden release of energy.

Chemicals that ignite and burn easily are fire hazards. So are chemicals that cause or support fire in other materials.

Explosives are chemicals that can cause a sudden and violent release of pressure, gas, and heat.

Reactive chemicals produce or release a hazard when allowed to contact certain other chemicals.

3) D	Oxidizers are fire hazards that supply the oxygen required to start or support a fire. Oxygen itself is an oxidizer. Many materials that contain oxygen, such as peroxides, are also oxidizers.
------	---

APPLICATION EXERCISE 3A-1: Defining Physical Hazards

Directions: Check or circle your answer(s) to each question, or write your answer in the blank provided. When you complete the exercise, fold over the right side of the page to check your answers. Then turn the page to get more information about each question.

1) What are the four basic types of *PHYSICAL* hazards?

_____	_____
_____	_____

2) Match the description with the type of physical hazard.

- | | |
|--|----------------------|
| ___ Contains a lot of stored energy. | A) Fire hazard |
| ___ Ignites and burns easily | B) Compressed gas |
| ___ Causes a sudden release of pressure and heat | C) Reactive chemical |
| ___ Causes a dangerous situation when mixed with other chemicals | D) Explosive |

3) Which type of physical hazard causes or supports fire in other materials?

- A) Combustible liquid
- B) Pyrophoric
- C) Flammable liquid
- D) Oxidizer

Answer Additional Information

- 4) *Remind students of the definition of FLASH POINT — the temperature at which a liquid gives off enough vapor to burst into flame when exposed to an ignition source. Write the following flash points on the chalkboard and poll trainees as to whether each liquid is flammable, combustible, or not a fire hazard. Reinforce definitions with answers.*

Chemical	Flash Point	Answer
Turpentine	95°F	A, Flammable
Kerosene	100-165°F	B, Combustible
Auto lubricating oil	300-450°F	C, Not a fire hazard
Toluene	40°F	A, Flammable
Methyl cellosolve	115°F	B, Combustible
Ethylene glycol	232°F	C, Not a fire hazard

The *FLASH POINT* is the temperature at which a liquid gives off enough vapor to burst into flame when exposed to an ignition source.

FLAMMABLE LIQUIDS have a flash point below 100°F. Turpentine and toluene are examples.

COMBUSTIBLE LIQUIDS have a flash point of 100°F or greater, but below 200°F. Kerosene and methyl cellosolve are examples.

Liquids that don't ignite easily at temperatures below 200°F are neither flammable nor combustible. Auto lubricating oil and ethylene glycol are examples.

- 5) **Note:** *You may wish to use the master at the back of this book (Appendix E, page E-8) to make an overhead of the label, or write the warning on the chalkboard.*

D Chemicals that must be kept away from other chemicals are reactive. The warning does not identify any specific type of fire hazard.

Note: *Direct trainees either to proceed to Application Exercise 3A-2 when finished or to wait for further instructions.*

4) Match each liquid with the type of fire hazard it presents.

- | | |
|--|---|
| ___ Turpentine ignites at 95°F. | A) Flammable liquid |
| ___ Kerosene ignites at 100-165°F. | B) Combustible liquid |
| ___ Auto lubricating oil ignites at 300-450°F. | C) Neither flammable
nor combustible |
| ___ Toluene ignites at 40°F. | |
| ___ Methyl cellosolve ignites at 115°F. | |
| ___ Ethylene glycol ignites at 232°F. | |

5) A label on a can of drain opener reads:

**NEVER USE OR MIX WITH OTHER CHEMICALS. KEEP AWAY FROM
ALUMINUM UTENSILS AND ALUMINUM-CONTAINING MATERIALS.**

Which type(s) of physical hazard does this product present?

- A) Flammable B) Oxidizer C) Pyrophoric D) Reactive
- _____

Now go back to page 3-5, fold over the right side of the page, and check your answers. Look on the back of the question page for more information on each question. If you are taking this course as a self-study, continue to Application Exercise 3A-2, "DOs and DON'Ts" when you have finished. If you are taking this course in a classroom situation, wait for further instructions from your trainer when finished.

TRAINER'S NOTES: APPLICATION EXERCISE 3A-2

Ask trainees to turn to page 3-9 of their Student Workbook. Either lead the class through Application Exercise 3A-2 as a group activity, or provide time for students to complete the exercise individually or in small groups. The answers and additional information given below appear on pages 3-10 and 3-12 of the Student Workbook.

Tailor these questions to your group by choosing questions related to operations or types of physical hazards present in your facility. For example, you may want to ask a trainee who sprays a solvent-based coating to describe the operation and identify the type(s) of physical hazard(s) present. You may also want to seek advice from a local specialist (health, safety, industrial hygienist) prior to the training session to help you customize these questions to your facility.

If time allows, ask the Optional Questions on page 3-16.

Answer Additional Information

Tell trainees: Larry works in the painting/coating operation of a manufacturing facility and does spray painting with a solvent-based paint.

List choices and ask: What physical hazard is associated with Larry's job?

- 1) C Like paints, many liquids used in solvent-based painting and coating operations are flammable. Ignition occurs easily at temperatures below 100°F.

Read each DO or DON'T statement and poll trainees on whether or not they think Larry should follow the procedure/practice.

- 2) A B C Proper disposal of waste containing flammable liquids is essential. Covered waste containers should be used to reduce the danger of exposure to an ignition source that could start a fire. Failure to properly dispose of paint-covered rags could also present a spontaneous combustion hazard. Fire extinguishers should be provided whenever a fire hazard exists.
- Smoking and electric heaters are potential ignition sources and are not allowed in areas where flammable liquids are present.
- No ash trays should be provided in the area because no one should smoke in there. Ash trays should be provided in the outer area so that cigarettes may be disposed of properly before entering the area.

APPLICATION EXERCISE 3A-2: DOs and DON'Ts

Directions: Check or circle your answer(s) to each question, or write your answer in the blank provided. When you complete the exercise, fold over the right side of the page to check your answers. Then turn the page to get more information about each question.

Larry works in the painting/coating operation of a manufacturing facility. He does spray painting with a solvent-based paint.

- 1) What physical hazard is associated with Larry's job?
 - A) Compressed gas
 - B) Pyrophoric
 - C) Flammable liquid
 - D) Explosive

- 2) Circle all the DOs and DON'Ts associated with the physical hazard in Larry's job.
 - A) DON'T throw paint-covered rags into open trash containers.
 - B) DO have a portable fire extinguisher available at all times.
 - C) DON'T use an electric heater in the work area.
 - D) DO provide ash trays in the work area.

Answer Additional Information

Tell trainees: Marilyn works as a supervisor in a plant that uses ammonium nitrate to make gun powder and blasting agents.

List choices and ask: What physical hazards are associated with the ammonium nitrate in the plant where Marilyn works?

- 3) B, C Ammonium nitrate is explosive and is an oxidizer. Heat or reaction with certain other chemicals (but not water) can cause an explosion.

Read each DO or DON'T statement and poll trainees on whether or not they think Marilyn should follow the procedure/practice.

- 4) A B C D Special precautions and training are required to work safely with explosives. Extreme care must be taken to prevent contact with an ignition source. Handling explosives outdoors during a thunderstorm is hazardous because lightning could detonate the material.

Special regulations also apply to warehousing explosive materials. Wide, clear aisles are required to make sure firefighting equipment can be brought in without delay. Explosives must be stored away from materials that ignite easily — a fire could detonate the explosive, and an explosion could ignite the fire hazard.

Note: *Direct trainees either to read the introduction to Videotape Segment 3B when finished, or to wait for further instructions. If time allows, ask the Optional Questions that begin on page 3-16 of this guide.*

Marilyn works as a supervisor in a plant that uses ammonium nitrate to make gun powder and blasting agents.

- 3) What physical hazard is associated with the ammonium nitrate in the plant where Marilyn works?
- A) Flammable liquid
 - B) Explosive
 - C) Oxidizer
 - D) Water-reactive chemical
- 4) What DOs and DON'Ts are associated with the physical hazard of ammonium nitrate in Marilyn's plant?
- A) DON'T carry matches or lighters into the work area.
 - B) DON'T store ammonium nitrate in the same warehouse where flammable or combustible chemicals are stored.
 - C) DO stop any surface operations during thunderstorms.
 - D) DO keep warehouse aisles wide and clear at all times.
-

Now go back to page 3-9, fold over the right side of the page, and check your answers. Look on the back of the question page for more information on each question. If you are taking this course as a self-study, proceed to Videotape Segment 3B when you have finished. If you are taking this course in a classroom situation, wait for further instructions from your trainer when finished.

TRAINER'S OPTIONAL QUESTIONS: Application Exercise 3A-2

Tailor these questions to your group by choosing questions related to operations or types of physical hazards present in your facility. For example, you may want to ask a trainee who sprays a solvent-based coating to describe the operation and identify the type(s) of physical hazard(s) present.

You may also want to seek advice from a local specialist (health, safety, industrial hygienist) prior to the training session to help you customize these questions to your facility.

O1) *Tell trainees: Karen works as a fire safety inspector and checks carbon dioxide cylinders connected to extinguisher systems.*

List choices and ask: What physical hazard is associated with the cylinders Karen inspects?

- A) Compressed gas
- B) Water-reactive chemical
- C) Flammable liquid
- D) Pyrophoric

Answer: A; Compressed Gas

Carbon dioxide is a gas. It is compressed into cylinders and used to put out fires involving flammable or combustible liquids.

Water-reactive chemicals and fire hazards are not used as extinguishing agents.

STUDENT WORKBOOK: No Reference

TRAINER'S OPTIONAL QUESTIONS: Application Exercise 3A-2 Continued

O2) *Read each DO or DON'T statement below and poll trainees on whether or not they think Karen should follow the procedure/practice.*

- A) DON'T use sparking tools in the area where the carbon dioxide cylinders are stored.
- B) DO use a power wrench to tighten the gas cylinder valves.
- C) DO make sure the cylinders are properly secured.
- D) DON'T drop, bang, or shock the cylinders.

Answer: Answer: C, D

Sparking tools (electric saws, drills, etc.) should not be used near fire hazards. Carbon dioxide is not a fire hazard — it's used to put out fires.

Compressed gases contain a lot of stored energy. A power wrench could easily break the valve stem and turn the cylinder into a powerful rocket.

Securing compressed gas cylinders and handling them properly helps avoid physical damage that could result in a rocket-type disaster.

O3) *Tell trainees: Sara works at a hospital where oxygen is used to treat patients with respiratory diseases.*

List choices and ask: What physical hazard is associated with the oxygen in Sara's workplace?

- A) Oxidizer
- B) Flammable liquid
- C) Water-reactive chemical
- D) Unstable chemical

Answer: A ; Oxidizer

Oxygen is an oxidizer. It can start fires in other materials, and it is one of three essential ingredients of fire itself. (The other two are fuel and heat.)

STUDENT WORKBOOK: No Reference

TRAINER'S OPTIONAL QUESTIONS: Application Exercise 3A-2 Continued

O4) *Read each DO or DON'T statement below and poll trainees on whether or not they think Sara should follow the procedure/practice.*

- A) DON'T smoke in areas where oxygen is used or stored.
- B) DON'T store oxygen cylinders near flammable gases.
- C) DON'T eat or drink in areas where oxygen is being used.
- D) DO use hand trucks to transport oxygen cylinders.

Answer: A, B, D

Although not flammable itself, oxygen gas must be kept away from ignition sources and flammable materials because it makes fires start easily and burn with great intensity.

Hand trucks should be used to transport all compressed gas cylinders. This helps prevent cylinder damage or shock that could release the energy stored in the compressed gas.

Oxygen gas is present in the air and essential for human life. If swallowed, it is not a health hazard. We swallow dissolved oxygen every time we drink a glass of water.

STUDENT WORKBOOK: No Reference

TRAINER'S NOTES: Introduction to Videotape Segment 3B

Note: *Ask trainees to look at the videotape introduction on page 3-13 of the Student Workbook.*

Ask trainees to recall the definition of a health hazard — chemicals that can cause injury or illness when you are exposed by skin or eye contact, skin absorption, inhalation, or ingestion.

Remind trainees that the health effects depend on the type of health hazard.

- As we watch this videotape, you should learn to recognize —
 - the different types of health hazards; and
 - the health effects each type can produce.

INTRODUCTION TO VIDEOTAPE SEGMENT 3B: Types of Health Hazards

Health hazards are chemicals that can cause injury or illness when you are exposed by skin or eye contact, skin absorption, inhalation, or ingestion. The type of injury or illness —

- ranges from short-term irritation to permanent damage or death; and
- depends on the type of health hazard.

As you watch this videotape segment, look for the different types of health hazards and the health effects each type can produce.

Now, watch Videotape Segment 3B.

TRAINER'S NOTES: Application Exercise 3B-1

Ask trainees to turn to page 3-15 of their Student Workbook. Either lead the class through Application Exercise 3B-1 as a group activity, or provide time for students to complete the exercise individually or in small groups. The answers and additional information given below appear on pages 3-16 and 3-18 of the Student Workbook.

Answer	Additional Information
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1)	<i>You may wish to list the eight types of health hazards (choices A-H) on the chalkboard and ask, "Which type of hazard _____?" for each description.</i>
----	--

- | | |
|---|--|
| B | Burns skin on contact |
| E | Causes cancer |
| A | Causes the skin to itch upon contact |
| G | Damages genes in sperm and egg cells |
| D | Can cause an allergic-like response |
| C | Causes liver damage |
| F | Damages the fetus during its development |
| H | Freezes the skin on contact |

CORROSIVES burn on contact, causing visible damage or irreversible changes to body tissues.

CARCINOGENS are chemicals that can cause cancer.

IRRITANTS react with the body at the site of contact, causing the skin to redden or itch. Repeated contact can crack or break the skin, but the damage is reversible.

MUTAGENS cause genetic changes in sperm and egg cells. This can cause sterility, birth defects, and miscarriages.

SENSITIZERS cause an allergic-like response in many people who are repeatedly exposed to the chemical. The response can happen on the second exposure, or any exposure thereafter.

TARGET ORGAN CHEMICALS damage a specific organ or body system, such as the liver.

TERATOGENS are reproductive hazards that damage the fetus during its development.

CRYOGENICS are very cold materials that cause frostbite by freezing body tissues on contact.

APPLICATION EXERCISE 3B-1: Defining Health Hazards

Directions: Check or circle your answer(s) to each question, or write your answer in the blank provided. When you complete the exercise, fold over the right side of the page to check your answers. Then turn the page to get more information about each question.

1) Match the description with the type of health hazard.

- | | |
|--|--------------------------|
| ___ Burns skin on contact | A) Irritant |
| ___ Causes cancer | B) Corrosive |
| ___ Causes the skin to itch on contact | C) Target organ chemical |
| ___ Damages genes in sperm and egg cells | D) Sensitizer |
| ___ Can cause an allergic-like response | E) Carcinogen |
| ___ Causes liver damage | F) Teratogen |
| ___ Damages the fetus during its development | G) Mutagen |
| ___ Freezes the skin on contact | H) Cryogenic |

Answer Additional Information

- 2) B There is no way to tell who will become sensitized to a chemical nor how long it may take. The allergic-like response can appear on any exposure after your first exposure.
- Some workers become sensitized over time. Suddenly they develop symptoms that they never had before — usually itching, a skin rash, or difficulty breathing. Others who are repeatedly exposed to the same sensitizer never develop the allergic-like response.
- 3) B Corrosives burn on contact. They can damage your skin, eyes, digestive tract, or respiratory system. The tissue damaged depends on the exposure route.
-

Note: *Direct trainees either to proceed with Application Exercise 3B-2 when finished, or to wait for further instructions.*

2) Will you know if you have been sensitized to a chemical at the time of your first exposure?

A) Yes

B) No

3) Do corrosives damage only skin?

A) Yes

B) No

Now go back to page 3-15, fold over the right side of the page, and check your answers. Look on the back of the question page for more information on each question. If you are taking this course as a self-study, continue to Application Exercise 3B-2, "Recognizing Workplace Health Hazards," when you have finished. If you are taking this course in a classroom situation, wait for further instructions from your trainer when finished.

Ask trainees to turn to page 3-19 of their Student Workbook. Either lead the class through Application Exercise 3B-2 as a group activity, or provide time for students to complete the exercise individually or in small groups. The answers and additional information given below appear on page 3-20 of the Student Workbook.

Note: *The purpose of this exercise is to help trainees understand the general relationship between certain symptoms and certain types of chemicals. It is less critical that they know the particular symptoms and chemicals included in this segment.*

Answer	Additional Information
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1) D	Like many maintenance cleaning products, dilute ammonia water is an irritant. The vapors cause reddening and irritation on contact.
------	---

Proper ventilation is a must when working with irritants that become airborne easily. When the ventilation system is working properly, the vapors are diluted with fresh air. This lowers the exposure hazard by reducing Fran's dosage, and she experiences no irritating symptoms.

Cryogenics are very cold chemicals that can freeze body tissue on contact, causing frostbite.

Corrosives burn on contact. The damage is more severe than that produced by an irritant and may be irreversible.

Teratogens damage the fetus during its development.

2) A	Corrosives eat away or burn body tissue on contact. Caustic cleaners are corrosives. So are other strong acids and bases.
------	---

Skin contact causes burns, like Jack's. Eye contact can permanently damage your eyesight. Breathing corrosive gases, vapors, or mists can severely damage the respiratory tract. When swallowed, corrosives burn the mouth and esophagus.

Note: *Direct trainees either to proceed to the Lesson Summary when finished, or to wait for further instructions. If time allows, ask the Optional Questions that begin on page 3-30 of this guide.*

APPLICATION EXERCISE 3B-2: Recognizing Workplace Health Hazards

Directions: Check or circle your answer(s) to each question, or write your answer in the blank provided. When you complete the exercise, fold over the right side of the page to check your answers. Then turn the page to get more information about each question.

- 1) Fran uses ammonia water to clean floors and tiled walls. One day, the air conditioning system stopped working in the room where Fran was cleaning. Her eyes got red and irritated, and her nose and throat hurt. What kind of health hazard is the ammonia cleaner?
- A) Corrosive
 - B) Teratogen
 - C) Cryogenic
 - D) Irritant
- 2) Jack works in a metal cleaning operation. He was burned when the caustic cleaner splashed on his arm. What kind of health hazard is the cleaner?
- A) Corrosive
 - B) Sensitizer
 - C) Irritant
 - D) Mutagen
-

Now fold over the right side of the page, and check your answers. Look on the back of the question page for more information on each question. If you are taking this course as a self-study, proceed to the Lesson Summary when you have finished. If you are taking this course in a classroom situation, wait for further instructions from your trainer.

TRAINER'S OPTIONAL QUESTIONS: Application Exercise 3B-2

Ask questions O1 and O2 as given, or locate MSDSs for a few familiar chemical materials in your facility (ones that all your trainees either use or can be expected to recognize, such as ammonia cleaner, a common gas, or a solvent) and ask the following:

- What is _____ used for?
- What do you think _____ can do to you?
- What type of health hazard is _____?

The health hazard data section of the MSDS should give you the answers to the last two questions. If it does not do so clearly, choose another material or consult a local expert about the correct answers.

O1) *Tell trainees: Liz and her friend worked twenty years ago for 6 months in a plant where benzidine was used to make dyes. This year, both have developed the same type of bladder cancer.*

List choices and ask: What type of health hazard is benzidine?

- A) Carcinogen
- B) Reproductive hazard
- C) Teratogen
- D) Corrosive

Answer: A; Carcinogen

Benzidine is one of the chemicals included in the special OSHA standard for thirteen carcinogens. It causes bladder cancer, which takes many years to develop.

No one knows the minimum dosage of benzidine required to cause cancer. This is true of all carcinogens. Thus, no exposure to a carcinogen is considered safe or free of cancer risk.

STUDENT WORKBOOK PAGE: No Reference

TRAINER'S OPTIONAL QUESTIONS: Application Exercise 3B-2 Continued

O2) *Tell trainees:* Jim uses urethane foam containing TDI (toluene diisocyanate) to make packaging materials. One day he suffers a severe asthmatic attack and can hardly breathe.

List choices and ask: What kind of health hazard is TDI?

- A) Irritant
- B) Sensitizer
- C) Reproductive
- D) Corrosive

Answer: B; Sensitizer

Like many isocyanates, TDI is a sensitizer. When Jim became sensitized, he experienced the allergic-like reaction associated with TDI — a severe asthmatic attack that makes breathing extremely difficult.

Jim worked with the foam many times before experiencing the allergic-like reaction. Other workers become sensitized on their first exposure, and suffer an asthmatic attack on their second exposure.

STUDENT WORKBOOK: No Reference

TRAINER'S NOTES: Review of Videotape Segment 3A

If time permits, review and reinforce learning objectives by asking the following open-ended questions answered in the Summary. After each question ask for specific examples from the trainees' work environment. Draw attention to the Summary for future reference.

Q1) What are the four basic types of physical hazards? (List and define.)

Answer:

- **COMPRESSED GASES** — contain a lot of stored energy. Sudden release produces rocket effect.
- **EXPLOSIVES** — cause a sudden release of pressure and heat.
- **FIRE HAZARDS** — ignite and burn easily or cause/support fire in other materials.
- **UNSTABLE/REACTIVE CHEMICALS** — produce or release hazards under commonly occurring temperatures, pressures, or light conditions.

Q2) What are the four types of fire hazards? (List and define.)

Answer:

- **PYROPHORICS** — ignite spontaneously in air below 130°F.
- **FLAMMABLE LIQUIDS** — ignite easily at temperatures below 100°F.
- **COMBUSTIBLE LIQUIDS** — ignite easily at or above 100°F, but below 200°F.
- **OXIDIZERS** — supply the oxygen required to start or support fire.

Q3) What three types of hazards are classified as unstable or reactive? (List and define.)

Answer:

Unstable and reactive chemicals produce or release hazards under commonly occurring temperatures, pressures, or light conditions.

- **DECOMPOSITION HAZARDS** — easily break up into simpler substances.
- **POLYMERIZATION HAZARDS** — self-react to form long molecular chains, releasing heat and/or a hazardous chemical in the process.
- **WATER-REACTIVE CHEMICALS** — react violently with water resulting in physical and/or health hazards.

LESSON 3 SUMMARY

The Hazard Communication Standard helps protect you from both physical hazards and health hazards in the workplace.

PHYSICAL HAZARDS include:

- *COMPRESSED GASES* — contain a lot of stored energy, sudden release produces rocket effect.
- *EXPLOSIVES* — cause a sudden release of pressure and heat.
- *FIRE HAZARDS* — ignite and burn easily or cause/support fire in other materials.
- *UNSTABLE/REACTIVE CHEMICALS* — produce or release hazards under commonly occurring temperatures, pressures, or light conditions.

FIRE HAZARDS include:

- *PYROPHORICS* — ignite spontaneously in air below 130°F.
- *FLAMMABLE LIQUIDS* — ignite easily at temperatures below 100°F.
- *COMBUSTIBLE LIQUIDS* — ignite easily at or above 100°F, but below 200°F.
- *OXIDIZERS* — supply the oxygen required to start or support fire.

UNSTABLE/REACTIVE CHEMICALS include:

- *DECOMPOSITION HAZARDS* — easily break up into simpler substances.
- *POLYMERIZATION HAZARDS* — self-react to form long molecular chains, releasing heat and/or a hazardous chemical in the process.
- *WATER-REACTIVE CHEMICALS* — react violently with water resulting in physical and/or health hazards.

STUDENT WORKBOOK PAGE: 3-21

TRAINER'S NOTES: Review of Videotape Segment 3B

Q1) What are the seven basic types of health hazards? (List and define.)

Answer:

- *IRRITANTS* — cause reddening, itching, or other irritation on contact.
- *CORROSIVES* — burn or eat away body tissues on contact.
- *CRYOGENICS* — freeze body tissue on contact.
- Chemicals that damage a *SPECIFIC ORGAN OR SYSTEM*.
- *REPRODUCTIVE HAZARDS* — target the reproductive system, causing sterility, miscarriages, fetal injury, or birth defects.
- *SENSITIZERS* — cause an allergic-like response in many people who are repeatedly exposed.
- *CARCINOGENS* — cause cancer.

Q2) What are the two types of reproductive hazards? (List and define.)

Answer:

- *MUTAGENS* — damage genes in egg or sperm cells.
- *TERATOGENS* — damage the fetus during its development.

HEALTH HAZARDS include:

- **IRRITANTS** — cause reddening, itching, or other irritation on contact.
- **CORROSIVES** — burn or eat away body tissues on contact.
- **CRYOGENICS** — freeze body tissue on contact.
- Chemicals that damage a **SPECIFIC ORGAN OR SYSTEM**.
- **REPRODUCTIVE HAZARDS** — target the reproductive system, causing sterility, miscarriages, fetal injury, or birth defects.
- **SENSITIZERS** — cause an allergic-like response in many people who are repeatedly exposed.
- **CARCINOGENS** — cause cancer.

REPRODUCTIVE HAZARDS include:

- **MUTAGENS** — damage genes in egg or sperm cells.
- **TERATOGENS** — damage the fetus during its development.

LESSON 4: CONTROLLING CHEMICAL HAZARDS

TRAINER'S NOTES: Introduction and Learning Objectives

Ask trainees to look at the Introduction and Learning Objectives of page 4-1 of their Student Workbook and emphasize the following:

- Now that you've seen the types of hazards that chemical materials present, it is time to see how these hazards are controlled.
- In this lesson, you'll see —
 - how engineering, personal protective equipment, and administrative/procedural controls help reduce the risk of injury or illness associated with chemical hazards in the workplace; and
 - how you can help to identify uncontrolled hazards in your facility.

LESSON 4: CONTROLLING CHEMICAL HAZARDS

INTRODUCTION

Everyone who works with chemical hazards needs to know how the hazards are controlled. This lesson introduces you to engineering controls, personal protective equipment, and administrative controls that may be required to protect you from chemical hazards in your workplace. Then it describes ways that you can detect uncontrolled hazards and help make your workplace safer for everyone.

LEARNING OBJECTIVES

When you have completed this lesson, you should be able to do the following:

- ☐ List and define three basic types of engineering controls.
- ☐ Identify examples of substitution, isolation, and ventilation controls.
- ☐ Distinguish between general and local exhaust ventilation.
- ☐ Define personal protective equipment and identify limitations that apply to its use.
- ☐ Match types of Personal Protective Equipment (PPE) with types of physical hazards or exposure hazards.
- ☐ List and identify four basic types of administrative controls.
- ☐ List and recognize four common ways that workers can identify uncontrolled chemical hazards.

TRAINER'S NOTES: Learning Resources

Videotape Segment 4A is located on Tape 1.

Videotape Segment 4B is located on Tape 2.

Note: On VHS or BETA videotapes, all seven segments are on one videotape.

TRAINER'S NOTES: Directions for Proceeding

Direct trainees to disregard page 4-2 in the Student Workbook and to proceed to page 4-3 in the Workbook.

LEARNING RESOURCES

- Videotape Segment 4A: Controlling Chemical Hazards: Engineering Controls, Personal Protective Equipment
- Workbook Application Exercise 4A: Working With Engineering Controls and PPE
- Videotape Segment 4B: Administrative Controls and Hazard Recognition
- Workbook Application Exercise 4B: Controlling Chemical Hazards: Administrative Controls
- Lesson Summary

DIRECTIONS FOR PROCEEDING

Complete the following steps in order. You might want to check off each step as you complete it.

- ___ 1) Read the workbook introduction to Videotape Segment 4A.
- ___ 2) Watch Videotape Segment 4A.
- ___ 3) Complete Application Exercise 4A in this workbook.
- ___ 4) Read the workbook introduction to Videotape Segment 4B.
- ___ 5) Watch Videotape Segment 4B.
- ___ 6) Complete Application Exercise 4B in this workbook.
- ___ 7) Read the lesson summary.

TRAINER'S NOTES: Introduction to Videotape Segment 4A

Note: *Ask trainees to look at the videotape introduction on page 4-3 of the Student Workbook.*

Controlling chemical hazards often requires a combination of control methods. In this videotape segment, you'll see how one facility decided to use a combination of engineering controls and personal protective equipment to protect workers from the hazards associated with use of a corrosive cleaner.

■ As we watch this videotape, you should learn —

- what types of engineering controls are available and how each is used to help protect you;
- the difference between general and local exhaust ventilation and appropriate applications for each;
- how personal protective equipment is used to control both physical hazards and health hazards; and
- why proper selection and use of PPE is essential to your safety and health.

INTRODUCTION TO VIDEOTAPE SEGMENT 4A:

Engineering Controls and Personal Protective Equipment

Controlling chemical hazards often requires a combination of control methods. In this videotape segment, you'll see how one facility decided to use a combination of engineering controls and personal protective equipment to protect workers from the hazards associated with use of a corrosive cleaner.

Notice the different types of engineering controls available to protect you from chemical hazards. Also watch for examples of how each type is used. Pay particular attention to the distinction between general and local exhaust ventilation, and learn to recognize appropriate applications for each. Then look for the types of personal protective equipment available to control both physical hazards and health hazards. Finally, learn why proper selection and use of PPE is essential to your safety and health.

Now, watch Videotape Segment 4A.

TRAINER'S NOTES: Application Exercise 4A

Ask trainees to turn to page 4-5 of their Student Workbook. Either lead the class through Application Exercise 4A as a group activity, or provide time for trainees to complete the exercise individually or in small groups. The answers and additional information given below appear on page 4-6 of the Student Workbook.

Answer**Additional Information**

- 1) A Using steam cleaning instead of solvent-based cleaning
B Wearing chemical splash goggles
A Using a ventilation system to remove toxic dusts
A Complete enclosure of a sand blast operation
B Wearing a respirator to remove toxic vapors from your breathing air
- Engineering controls include:
- **SUBSTITUTION** — replacing a hazardous chemical, process, or piece of equipment with a less hazardous one
 - **ISOLATION** — using an enclosure, barrier, or distance to separate workers from hazards
 - **VENTILATION** — mixing fresh air with contaminated air in a work area, or preventing release of airborne hazards by removing them at the source.
- Personal protective equipment (PPE) includes eyewear, face masks, clothing, gloves, boots, and respirators — equipment that workers wear to prevent or reduce their exposure to hazardous chemicals.
- 2) C Substitution can be used to do any of the following:
- Replace a hazardous **CHEMICAL**, such as lead-based pigment, with a less hazardous chemical, such as a non-toxic pigment.
 - Replace a hazardous **PROCESS**, such as solvent-based cleaning, with a less hazardous process, such as steam cleaning.
 - Replace a hazardous **PIECE OF EQUIPMENT**, such as a broom, which can create a dust hazard, with a more efficient piece of equipment, such as a wet vacuum cleaner.

Note: *Direct trainees either to read the introduction to Videotape Segment 4B when finished, or to wait for further instructions. If time allows, ask the Optional Questions that begin on page 4-10 of this guide.*

APPLICATION EXERCISE 4A:
Working With Engineering Controls and PPE

Directions: Check or circle your answer(s) to each question, or write your answer in the blank provided. When you complete the exercise, fold over the right side of the page to check your answers. Then turn the page to get more information about each question.

1) Match the application with the type of control method.

- | | |
|--|--|
| <input type="checkbox"/> Using steam cleaning instead of solvent-based cleaning | A) Engineering |
| <input type="checkbox"/> Wearing chemical splash goggles | B) Personal Protective Equipment (PPE) |
| <input type="checkbox"/> Using a ventilation system to remove toxic dusts | |
| <input type="checkbox"/> Complete enclosure of a sand blast operation | |
| <input type="checkbox"/> Wearing a respirator to remove toxic vapors from your breathing air | |

2) Most paints no longer contain lead-based pigments because lead paint is a health hazard. What type of control is used when lead-based pigments are replaced by non-toxic pigments?

- A) Isolation
- B) Ventilation
- C) Substitution
- D) PPE

Now fold over the right side of the page, and check your answers. Look on the back of the question page for more information on each question. If you are taking this course as a self-study, proceed to Videotape Segment 4B when you have finished. If you are taking this course in a classroom situation, wait for further instructions from your trainer when finished.

TRAINER'S OPTIONAL QUESTIONS: Application Exercise 4A

O1) *Tell trainees:* Using a high-speed orbital sander to get vehicles ready for painting produces a serious dust hazard.

List choices and ask: Which action is an appropriate example of a substitution control for this hazard?

- A) Have workers wear dust masks instead of cartridge respirators.
- B) Replace high-speed orbital sanders with sanders fitted with vacuum nozzles.
- C) Change respirator filters when they get clogged with dust.

Answer: B

Sanders with vacuum nozzles control the dust hazard by capturing the dust before it becomes airborne. Replacing one type of sander with another is an example of controlling a hazard by substituting a more efficient piece of equipment. This could also be considered ventilation control since the vacuum introduces local ventilation which captures the dust at the source.

Dust masks provide less protection than other types of respirators, not more. Substituting a cartridge-type respirator for a dust mask might control an exposure hazard better; the reverse substitution would not.

Respirator filters do need to be cleaned or replaced periodically, but replacing an old filter with a new one does not introduce a new control method.

STUDENT WORKBOOK PAGE: No Reference

TRAINER'S OPTIONAL QUESTIONS: Application Exercise 4A **Continued**

For questions O2 through O4, tell trainees: Mark uses a strong ammonium hydroxide cleaner to clean tile walls and floors. The cleaner comes in a spray bottle. To protect against the irritating liquid and vapor or gas, he uses a combination of controls.

- O2)** *Ask trainees:* What type of control is Mark using when he opens the windows to provide a cross draft?

Answer: Ventilation

OPENING THE WINDOWS provides *VENTILATION* — fresh air to dilute the vapors in the room where Mark is working.

- O3)** *Ask trainees:* What type of control is Mark using when he wears impervious gloves and splash goggles?

Answer: PPE

Any equipment you wear, such as *GLOVES* or *GOGGLES*, is *PERSONAL PROTECTIVE EQUIPMENT* — *PPE*.

- O4)** *Ask trainees:* What type of control is Mark using when he applies the cleaner with a sponge, rather than spraying it?

Answer: Process substitution

Mark *SUBSTITUTED SPONGE* application for *SPRAY* application. This change in process helps control the hazard by eliminating the formation of irritating mists.

STUDENT WORKBOOK: No Reference

- O5)** *Tell trainees:* A small dip painting operation in a large work area produces small amounts of a mildly irritating vapor that mixes readily with air.

List choices and ask: Which type of protective equipment is most appropriate for controlling this hazard?

- A) General ventilation
- B) Local exhaust ventilation
- C) Air-supplied respirator
- D) Air-purifying respirator

Answer: B; Local exhaust ventilation

Local exhaust ventilation is most appropriate for controlling airborne hazards having the following characteristics:

- Degree of hazard is low — airborne chemical is *NOT* very toxic (e.g., mild irritant), and airborne amounts are not great (e.g., dip painting).
- Airborne hazard mixes readily with air.

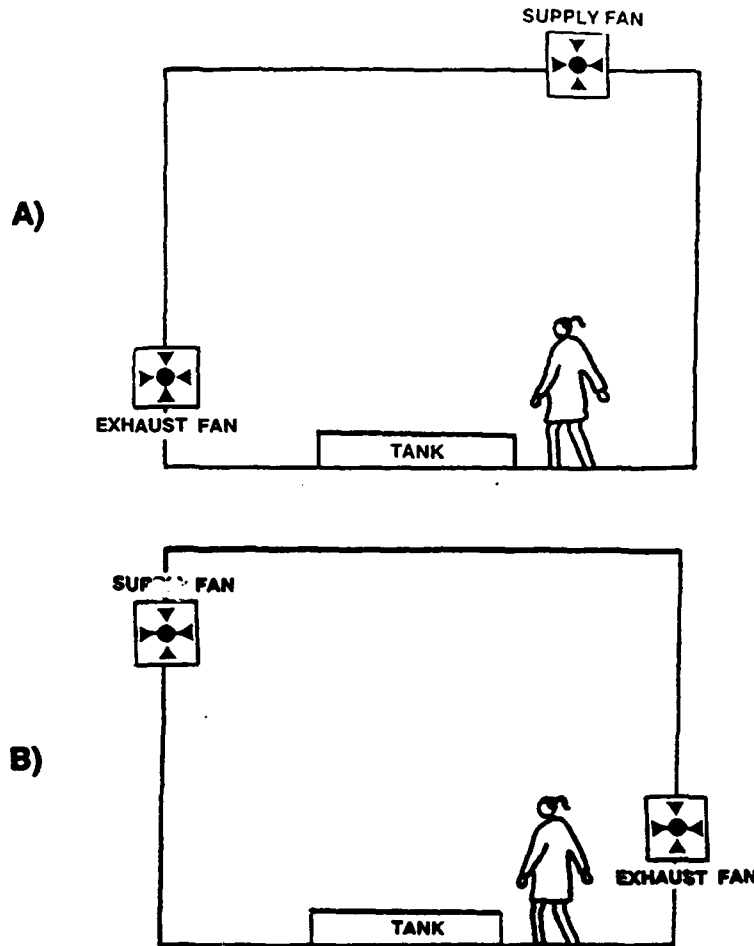
A large volume of air is needed for dilution; therefore local exhaust ventilation is better. General ventilation would require dilution and spreading throughout the shop.

Either local exhaust ventilation or respiratory PPE is required to control more serious exposure hazards.

STUDENT WORKBOOK: No Reference

TRAINER'S OPTIONAL QUESTIONS: Application Exercise 4A Continued

- O6)** Use the masters in the back of this book (Appendix E, pages E-11 and E-12) to make an overhead of the following pictures, or sketch the pictures on the chalkboard using stick figures.

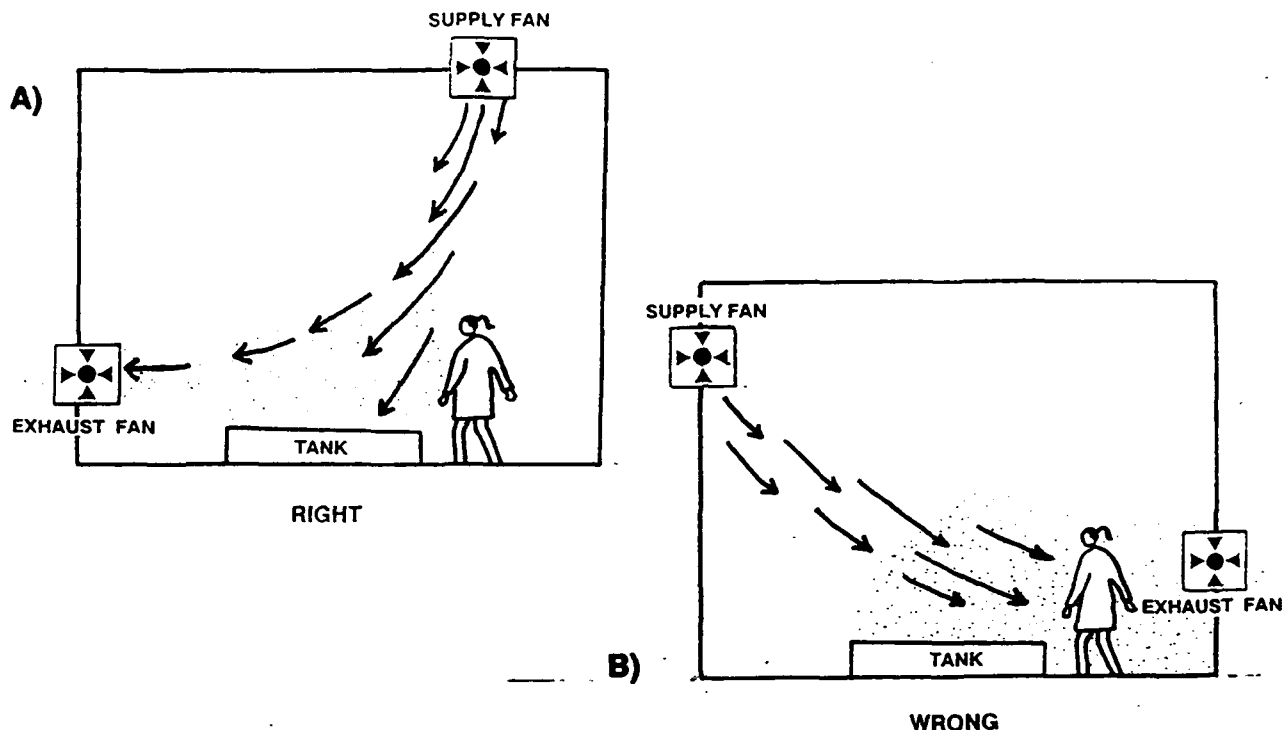


Ask trainees: Which picture shows the correct placement of the two fans used to provide general ventilation?

Answer: A

To protect you, a general ventilation system must dilute the contaminant in the workplace air and move the airborne hazard **AWAY** from you, not pull it toward you.

STUDENT WORKBOOK: No Reference



O7) Use the master in the back of this book (Appendix E, pages E-11 to E-12) to make an overhead illustrating different types of protective equipment, or bring in different types of protective eyewear and ask trainees to suggest appropriate applications for each.

Answer:

ORDINARY SAFETY GLASSES protect best against eye injury caused by impact or projectiles, such as flying particles. This type of protection is required when operating a table saw.

Even with side shields, safety glasses do *NOT* provide a sealed barrier against liquid chemicals. If a splash could cause serious eye injury, you need splash goggles and a full face shield.

CHEMICAL SPLASH GOGGLES keep liquids out of the eyes. This type of eyewear protects against splashes.

FACE SHIELDS protect both the face and eyes. These devices may be used alone or in conjunction with other protective eyewear such as safety glasses and chemical splash goggles, depending on the chemical and physical hazard to be encountered.

GAS-PROOF GOGGLES keep gases, vapors, mists, fumes, and dust out of the eyes.

STUDENT WORKBOOK: No Reference

TRAINER'S OPTIONAL QUESTIONS: Application Exercise 4A Continued

List the two types of respiratory protection (A and B) on the chalkboard and then ask questions O8 through O11.

A) Air-purifying respirator B) Air-supplied respirator

- O8)** What type of protection does Jerry need when he descends into a storage tank where there is very little oxygen?

Answer: B; Air-supplied respirator

Jerry needs an *AIR-SUPPLIED RESPIRATOR* because he is entering an area that lacks the oxygen he needs to live. Only air-supplied respirators supply oxygen.

- O9)** What type of protection does Al need when he sprays an insulating foam containing highly toxic isocyanates?

Answer: B; Air-supplied respirator

Al needs an *AIR-SUPPLIED RESPIRATOR* because he is working with a highly toxic material. Breathing even a little isocyanate could seriously injure him. The risk of this happening is much greater with an air-purifying respirator

- O10)** What type of protection does Liz need when she uses a vacuum to clean up a small amount of mercury spilled in a plant that makes communications gear?

Answer: A; Air-purifying respirator

Liz can use an *AIR-PURIFYING RESPIRATOR* to remove mercury vapors from the air she breathes. She could also wear an air-supplied respirator, but this probably isn't necessary.

STUDENT WORKBOOK PAGE: No Reference

- O11)** What type of protection does Marge need when she uses a power tool to sand paint off outdoor stairs?

Answer: A; Air-purifying respirator

Sanding painted surfaces produces paint dust, which is a health hazard. Because she is working outside, Marge has a natural, general ventilation system to dilute the hazard. Thus, the right type of *DUST MASK* may suffice.

- O12)** *Read each statement below and poll the class on whether it is true or false. Invite someone who answers correctly to explain the correct answer.*

(T) PPE only protects the worker who wears it.

(F) If a rubber glove works, so will a plastic glove.

(F) Proper fit is only important for respirators.

Answer: T(rue)

PPE is *PERSONAL* protection. It protects only the person who wears it AND uses it correctly.

The glove *MATERIAL* must be selected to match the specific hazard. Like skin, the same glove material can be a barrier for some liquids and not for others. A solvent that can't get through rubber might pass through a plastic glove — or dissolve it.

All PPE must fit properly. Proper fit is critical for respirators because a leaky facemask allows the wearer to breath the airborne hazard. Although an oversized glove may still prevent skin contact, it also hinders dexterity. This hazard can cause an accident that results in injury or exposure to a health hazard.

STUDENT WORKBOOK PAGE: No Reference

- O13)** *Tell trainees:* Peter wears an air-purifying respirator to prevent exposure to toxic mists and vapors in a spray-painting operation. While wearing a respirator one day, he starts smelling an odor like turpentine.

List choices and ask: What could have happened?

- A) Peter's respirator needs a new filter or cartridge.
- B) Peter's respirator ran out of oxygen.
- C) Peter started growing a beard.
- D) Peter borrowed someone else's respirator.

Answer: A, C, D

A respirator is intended to prevent you from breathing a hazard. Because Peter can smell the hazard, he is breathing it. Thus, his respirator is not fully protecting him.

An air-purifying respirator contains a filter or cartridge that removes airborne hazards from the air. No filter or cartridge lasts forever. All respirators require proper maintenance to work correctly.

Respirators must also fit properly. The seal between the skin and the facemask must be airtight. Facial hair can make gaps in the seal that allow airborne hazards to enter the facemask and get into the lungs.

Because every face is different, everyone's respirator must be individually fitted. Never assume that a borrowed respirator will fit properly or that it will provide the protection needed.

STUDENT WORKBOOK PAGE: No Reference

TRAINER'S NOTES: Introduction to Videotape Segment 4B

Note: *Ask trainees to look at the videotape introduction on page 1-2 of the Student Workbook.*

Administrative or procedural controls are also used to protect you from chemical hazards.

- As we watch this videotape, notice how chemical hazards are controlled through —
 - information and training;
 - safe work practices;
 - good housekeeping and personal hygiene; and
 - environmental, personal, and medical monitoring.
- Also watch for ways that you can help reduce injury and illness by recognizing and reporting uncontrolled chemical hazards.

INTRODUCTION TO VIDEOTAPE SEGMENT 4B:

Administrative Controls

In addition to engineering controls and Personal Protective Equipment, controlling chemical hazards requires information and training, safe work practices, good housekeeping, good personal hygiene, and monitoring. As you watch this videotape, look for examples of each of these administrative controls.

Also pay close attention to ways that you can help to control chemical hazards. Notice how a simple change in work practices can reduce or eliminate an exposure. See why it's important to report any medical symptoms you may experience. And be alert for ways of using your senses to detect potential hazards.

Now, watch Videotape Segment 4B.

TRAINER'S NOTES: Application Exercise 4B

Ask trainees to turn to page 4-9 of their Student Workbook. Either lead the class through Application Exercise 4B as a group activity, or provide time for students to complete the exercise individually or in small groups. The answers and additional information given below appear on pages 4-10, 4-12, and 4-14 of the Student Workbook.

Answer	Additional Information
---------------	-------------------------------

- | | |
|------|---|
| 1) A | <p>A simple change in work practices and good personal hygiene can often help to control your exposure to a chemical hazard. For example:</p> <ul style="list-style-type: none">• Changing your position so you breathe less vapor• Washing your hands before eating or drinking• Handling volatile materials in a chemical laboratory hood• Covering or capping chemical containers when not in use |
|------|---|

- | | |
|------|---|
| 2) C | <p>The goal of housekeeping is to contain and remove hazards, and requires the following:</p> |
|------|---|

- Proper storage and handling
- Proper clean-up procedures
- Prompt removal and correct disposal of chemical wastes

Local ventilation captures chemical hazards at the source. General ventilation mixes and dilutes the hazard with air. PPE and isolation put barriers between people and hazards.

- | | |
|--------|--|
| 3) B D | <p>Reporting medical symptoms that may be caused by exposure to a health hazard in your work area tells your supervisor that —</p> |
|--------|--|

- an exposure hazard may exist; and
- you are on the alert for potential hazards.

Experiencing medical symptoms does NOT necessarily mean that the exposure is caused by your work practices, but it could be. Nor does it necessarily mean that medical monitoring is required. It DOES mean that a hazard MAY exist, and that this potential hazard should be evaluated and, if necessary, controlled.

Note: *You may wish to discuss the importance of reporting medical symptoms. Ask the trainees why this is important and what it tells the supervisor. Have them think about what is normal (sneezing from a cold) and what is job-related (sneezing from excessive dust exposure).*

APPLICATION EXERCISE 4B:
Administrative Controls and Hazard Recognition

Directions: Check or circle your answer(s) to each question, or write your answer in the blank provided. Remember, there may be more than one correct choice for a question. When you complete the exercise, fold over the right side of the page to check your answers. Then turn the page to get more information about each question.

- 1) Can a change in work practices help to control a chemical hazard?
 - A) Yes
 - B) No

- 2) How does good housekeeping help to control chemical hazards?
 - A) Capturing the hazard as it forms at the source
 - B) Mixing and diluting the hazard with air
 - C) Containing and removing the hazard
 - D) Putting a barrier between an individual worker and the hazard

- 3) Suppose you report exposure symptoms to your supervisor. What does this tell your supervisor?
 - A) You use sloppy work practices.
 - B) An exposure hazard may exist.
 - C) Routine medical monitoring is required.
 - D) You're on the alert for potential hazards.

TRAINER'S NOTES: Application Exercise 4A

Answer**Additional Information**

4) *Read each statement and poll trainees on whether they think it is true or false. Ask someone who responds correctly to explain.*

(F) I'll always be able to see, smell, or taste an exposure hazard.

(T) Most airborne hazards can *NOT* be seen.

(F) If a smell disappears, I am no longer breathing the chemical.

(T) Monitoring may be required to detect hazardous exposures, even if the chemical has a strong odor.

(T) Any chemical I can smell or taste is entering my body.

You cannot sense odorless, colorless, tasteless gases like carbon monoxide. Although you can see bulk solids and liquids, airborne forms are often invisible.

You can smell or taste some airborne hazards. But remember, anything you can smell or taste is also entering your body. Also remember that your sense of smell is limited.

You may not be able to smell the very small amounts of an airborne hazard that can harm you. Some chemicals also deaden your sense of smell — the smell disappears even though you're still breathing the hazard.

4) Label each statement either true or false.

- ☐ I'll always be able to see, smell, or taste an exposure hazard.
- ☐ Most airborne hazards can NOT be seen.
- ☐ If a smell disappears, I am no longer breathing the chemical.
- ☐ Monitoring may be required to detect hazardous exposures, even if the chemical has a strong odor.
- ☐ Any chemical I can smell or taste is entering my body.

Answer
Additional Information

- 5) *Read each clue and poll trainees whether or not they think it can alert someone to an uncontrolled hazard. Ask someone who responds correctly to explain.*

(Y) Drop in noise level near a ventilation system

(Y) Abnormal reading on a gas or vacuum gauge

(N) Worker with a cold sneezing

(Y) Liquid being used up more quickly than usual

(Y) Sound of a near-by explosion

(N) Maintenance worker vacuuming

(Y) Sudden build-up on exhaust vents

(Y) Unusual smell

(T) Burning sensation

Anything unusual may alert you to a potential hazard —

- Drop in noise level
- Abnormal gauge or meter readings
- Using up a material more quickly or slowly than usual
- Sounds associated with accidents or emergency situations, such as explosion or fire
- Changes in the way equipment or materials look
- An odor you don't normally smell
- A sensation you don't normally feel

- 6) A C

Medical monitoring helps to detect uncontrolled and improperly controlled exposure hazards. When a medical exam or lab test indicates an exposure problem, a hazard exists. Identifying, evaluating, and controlling this hazard prevents repeated exposure. Sometimes, it can also prevent occurrence of more serious health effects that develop slowly over time.

Immediate health effects appear while you are being exposed, or shortly thereafter. Medical monitoring itself cannot prevent occurrence of immediate symptoms or subsequent long-term health effects.

5) Which of the following clues alert you to a potential, uncontrolled health hazard?

- ☐ Drop in noise level near a ventilation system
- ☐ Abnormal reading on a gas gauge
- ☐ Worker with a cold sneezing
- ☐ Liquid being used up more quickly than usual
- ☐ Sound of a near-by explosion
- ☐ Maintenance worker vacuuming
- ☐ Sudden build-up on exhaust vents
- ☐ Unusual smell
- ☐ Burning sensation

6) Regina routinely handles mercury, a liquid that can build up in the body over time and can cause irreversible brain damage. How could medical monitoring help protect Regina?

- A) Detect uncontrolled exposure hazards
- B) Prevent occurrence of immediate exposure symptoms
- C) Prevent irreversible brain damage
- D) None of the above

Now go back to page 4-9, fold over the right side of the page, and check your answers. Look on the back of the question page for more information on each question. If you are taking this course as a self-study, proceed to the Lesson Summary when you have finished. If you are taking this course in a classroom situation, wait for further instructions from your trainer when finished.

Note: *Direct trainees either to proceed to the Lesson Summary when finished, or to wait for further instructions. If time allows, ask the Optional Questions that begin on page 4-36 of this guide.*

STUDENT WORKBOOK: No Reference

O1) *Read each control and ask trainees to identify it as an Administrative (A), Engineering (E), or Personal Protective Equipment (PPE) control.*

- (E) Substituting silicon/bronze welding for lead-based soldering
- (A) Requiring written hazard information and training
- (E) Installing a ventilation system
- (A) Using good work practices
- (A) Monitoring exposure levels
- (A) Storing chemicals properly
- (PPE) Wearing protective gloves and goggles
- (A) Removing chemical wastes for proper disposal

Answer: Administrative controls include the following:

- **DOCUMENTATION, INFORMATION, AND TRAINING** — such as warning labels, MSDSs, Inventory, and Hazard Communication Programs
- **SAFE WORK PRACTICES**
- **HOUSEKEEPING** — containing and removing chemical wastes; proper handling, storage, and waste disposal
- **MONITORING** — environmental, personal, and medical*

Substituting one chemical or process for another is an engineering control.
Ventilation is also an engineering control.

Gloves and goggles are personal protective equipment.

***Note:** *Medical monitoring may provide an alert that an uncontrolled hazard exists, but it may not be used as a control measure because it shows an effect that has already occurred to the body.*

STUDENT WORKBOOK: No Reference

- O2)** Which type of administrative control(s) can be used to check the effectiveness of other controls?

Answer: Monitoring

MONITORING is the administrative control used to check the effectiveness of other controls.

- O3)** Ask trainees to list examples of monitoring.

Answer: Environmental/Area, Personal, Medical

There are three types of monitoring.

- *ENVIRONMENTAL* or area monitoring samples air or work surfaces to check environmental levels of contamination in the workroom air, which could present potential exposure hazards.
- *PERSONAL* monitoring uses badges or other devices to measure an individual's level of exposure to potential hazards.
- *MEDICAL* monitoring uses baseline and periodic physicals and laboratory tests to diagnose exposure problems.

Note: *Medical monitoring may provide an alert that an uncontrolled hazard exists, but it may not be used as a control measure because it shows an effect that has already occurred to the body.*

- O4)** Tell trainees: Matt often has a headache by the end of the day but doesn't want to get labeled a complainer. Suppose he asks you: "Do you think I should tell my supervisor?"

List choices and ask trainees: Which questions are helpful in giving Matt advice?

- A) Do you work with chemicals that can cause headaches?
- B) Is anyone else in your area getting headaches?
- C) Does it go away if you take aspirin?
- D) Do you get headaches on your days off?

Answer: A, B, D

STUDENT WORKBOOK: No Reference

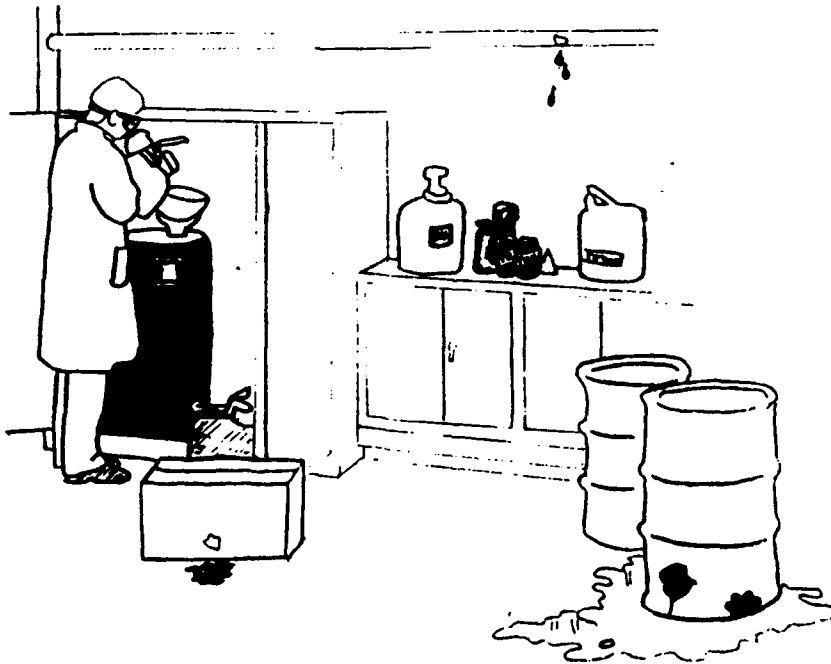
Many of the immediate health effects produced by chemical hazards are commonplace. Headaches, nausea, dizziness, and so on have many different causes. The following clues often help to identify work-related adverse health effects.

- Person works with a chemical that can cause the symptom.
- The other workers in the area have the same symptom.
- The symptom appears while at work and gets better or disappears during time off. In some cases, such as nitroglycerine exposure, symptoms will get worse after leaving work because of withdrawal from the work exposure.

Like any other headache, one caused by exposure to a workplace chemical may go away if aspirin is taken. But be aware that taking aspirin does not control the hazard — it just makes the immediate symptom go away.

O5) *Use the masters in the back of this book (Appendix E, pages E-9 and E-10) to make overheads or handouts of the following pictures.*

Ask trainees: What hazards should be reported?



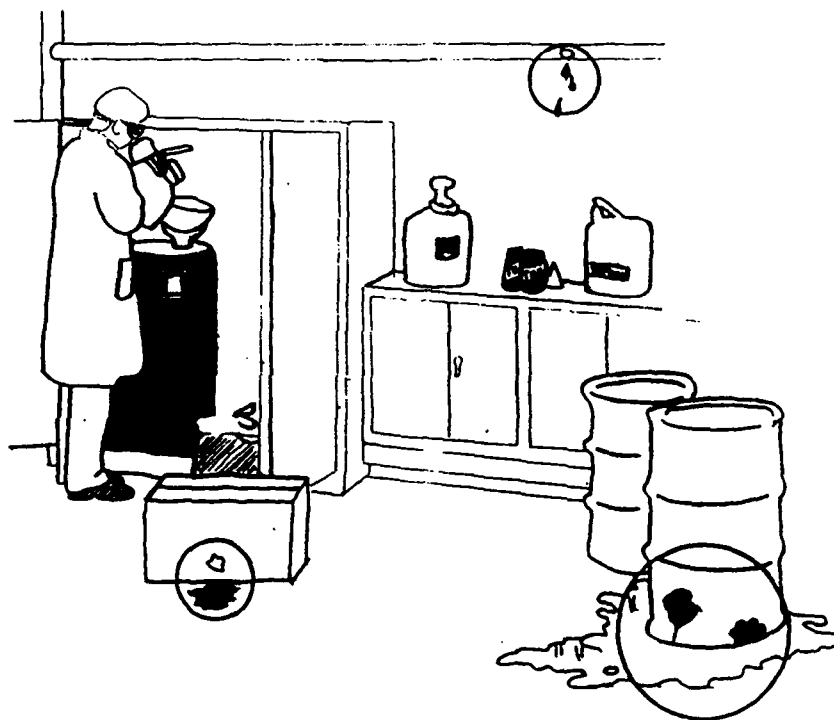
STUDENT WORKBOOK: No Reference

STUDENT WORKBOOK: No Reference

TRAINER'S OPTIONAL QUESTIONS: Application Exercise 4B **Continued**

O5) *(Continued)*

Answer: Damaged container, leaking pipe, and spill (circled in picture).



Rusted, dented, or otherwise damaged chemical containers are always potential hazards. Chemical leaks and spills allow chemicals to escape and always present a potential exposure hazard.

STUDENT WORKBOOK: No Reference

TRAINER'S NOTES: Review of Videotape Segment 4A

If time permits, review and reinforce the learning objectives by asking the following open-ended questions answered in the Summary. Draw attention to the Summary in the Student Workbook for future reference.

Q1) What are the three basic methods of controlling chemical hazards?

Answer: There are three basic methods of controlling chemical hazards.

- Engineering controls
- Personal Protective Equipment (PPE)
- Administrative controls

Q2) What are the four types of engineering controls? (List, define, and give an example of each.)

Answer: *ENGINEERING CONTROLS* include the following:

- *SUBSTITUTION* — replacing a chemical, process, or piece of equipment with a less hazardous or more efficient one.

Example: steam instead of solvent cleaning

- *ISOLATION* — using an enclosure, barrier, or safe distance to separate workers from exposure hazards.

Examples: machine enclosures, enclosed control rooms, splash guards

- *GENERAL VENTILATION* — mixing an airborne hazard with fresh air to reduce exposure levels; this is only suitable for hazards of low toxicity that mix readily with air.

Examples: fans, make-up air vents

- *LOCAL EXHAUST VENTILATION* — capturing an airborne hazard as it is released and taking it out of the workplace to eliminate exposure.

Examples: hoods, slots, and dust collectors

LESSON 4 SUMMARY

There are three basic methods of controlling chemical hazards.

- Engineering controls
- Personal Protective Equipment (PPE)
- Administrative controls

ENGINEERING CONTROLS include the following:

- **SUBSTITUTION** — replacing a chemical, process, or piece of equipment with a less hazardous or more efficient one.

Example: steam instead of solvent cleaning

- **ISOLATION** — using an enclosure, barrier, or safe distance to separate workers from exposure hazards.

Examples: machine enclosures, enclosed control rooms, splash guards

- **GENERAL VENTILATION** — mixing an airborne hazard with fresh air to reduce exposure levels; this is only suitable for hazards of low toxicity that mix readily with air.

Examples: fans, make-up air vents

- **LOCAL EXHAUST VENTILATION** — capturing an airborne hazard as it is released and taking it out of the workplace to eliminate exposure.

Examples: hoods, slots, and dust collectors

STUDENT WORKBOOK PAGE: 4-15

Q3) How does personal protective equipment work?

Answer: *PERSONAL PROTECTIVE EQUIPMENT* puts a barrier between the hazard and the individual who wears it. It can protect against both physical hazards and health hazards.

Q4) What types of PPE are used to protect against —

- physical hazards, such as fire?
- eye and skin contact/absorption hazards?
- inhalation hazards?
- lack of oxygen?

Answer: *PERSONAL PROTECTION EQUIPMENT* includes:

- *PROTECTIVE CLOTHING* (physical hazards, contact/ absorption hazards).

Examples: hats, hoods, boots, impervious gloves, rubber gloves, rubber aprons, lab coats, impervious boots, impervious suits.

- *EYE AND FACE PROTECTION* (physical hazards, contact/absorption hazards)

Examples: safety glasses, splash goggles, gas-proof goggles, face masks and shields.

- *AIR-PURIFYING RESPIRATORS* (inhalation hazards)

Examples: respirators with a cartridge or filter that removes contaminants from the air you breathe.

- *AIR-SUPPLIED RESPIRATORS* (inhalation hazards, lack of oxygen)

Examples: self-contained units that supply air from a tank carried on the back; air-line units that provide air from a remote source.

Q5) What factors are critical when relying on PPE to protect yourself from chemical hazards?

Answer: Selection, proper fit, correct use and maintenance

To protect someone, PPE must be matched to the specific hazard. For example, cloth gloves are useless for protection against a corrosive liquid. PPE is also useless unless workers wear it. Proper fit, correct use, and routine maintenance are also critical.

PERSONAL PROTECTIVE EQUIPMENT puts a barrier between the hazard and the individual who wears it. It can protect against both physical hazards and health hazards.

- **PROTECTIVE GLOVES AND CLOTHING**

Examples: hats, hoods, boots, impervious gloves, cloth gloves, rubber aprons, lab coats, impervious boots

- **EYE AND FACE PROTECTION**

Examples: safety glasses, splash goggles, face masks and shields

- **AIR-PURIFYING RESPIRATORS**

Examples: Respirators with a cartridge or filter that removes contaminants from the air you breathe

- **AIR-SUPPLIED RESPIRATORS**

Examples: Self-contained units that supply air from a tank carried on the back; air-line units that provide air from a remote source

To protect you, PPE must be matched to the specific hazard. For example, cloth gloves are useless for protection against a corrosive liquid. PPE is also useless unless you wear it. Proper fit, correct use, and routine maintenance are also critical.

TRAINER'S NOTES: Review of Videotape Segment 4B

Q1) What are the four different types of administrative controls? (List, define, and give examples of each.)

Answer: *ADMINISTRATIVE CONTROLS* include the following:

- *DOCUMENTATION, INFORMATION, AND TRAINING*

Examples: warning labels, MSDSs, Hazardous Chemical Inventory, written Hazard Communication Program

- *WORK PRACTICES*

Examples: using all available controls correctly, reporting uncontrolled hazards promptly

- *HOUSEKEEPING* — containing and removing hazards

Examples: vacuuming toxic dusts, proper storage and handling, correct disposal of chemical wastes

- *MONITORING* — checking the effectiveness of other controls

Examples: air and wipe samples for area monitoring, personal sampling for individual monitoring, medical exams and laboratory tests

Q2) How can you detect uncontrolled chemical hazards in your work area?

Answer: Using your senses, spotting equipment failures, spotting emergency/ accident situations, recognizing health effects, watching for anything unusual.

Always be alert for uncontrolled chemical hazards in the workplace. Bulk liquids and solids are visible, but most airborne hazards are invisible. Workers can smell or taste some airborne chemicals, but not others. Some chemicals deaden the sense of smell, and others cannot be detected by smell at the very low levels that are harmful. Remember, anything we smell or taste is entering the body.

In addition to sensing the chemical itself, you can detect exposure hazards by:

- Spotting equipment failures — a ventilation system that stops working, damaged chemical containers, faulty PPE.
- Spotting leaks, spills, fires, explosions, uncontrolled chemical reactions, or other emergency/accident situations.
- Recognizing health effects produced by exposure, such as headache, dizziness, coughing, irritation, or nausea
- Watching for anything unusual or out of the ordinary.

LESSON 4 SUMMARY

ADMINISTRATIVE CONTROLS include the following:

- **DOCUMENTATION, INFORMATION, AND TRAINING**

Examples: warning labels, MSDSs, Hazardous Chemical Inventory, written Hazard Communication Program

- **WORK PRACTICES**

Examples: using all available controls correctly, reporting uncontrolled hazards promptly

- **HOUSEKEEPING** — containing and removing hazards

Examples: vacuuming toxic dusts, proper storage and handling, correct disposal of chemical wastes

- **MONITORING** — checking the effectiveness of other controls

Examples: Air and wipe samples for area monitoring, personal sampling for individual monitoring, medical exams and laboratory tests

Always be alert for uncontrolled chemical hazards in your workplace. You can see bulk liquids and solids, but most airborne hazards are invisible. You can smell or taste some airborne chemicals, but not others. Some chemicals deaden your sense of smell, and others cannot be detected by smell at the very low levels that can harm you.

Remember, anything you smell or taste is entering your body.

In addition to sensing the chemical itself, you can detect exposure hazards by doing the following:

- Spotting equipment failures — a ventilation system that stops working, damaged chemical containers, faulty PPE
- Spotting leaks, spills, fires, explosions, uncontrolled chemical reactions, or other emergency/accident situations
- Recognizing health effects produced by exposure, such as headache, dizziness, coughing, irritation, or nausea
- Watching for anything unusual or out of the ordinary.

STUDENT WORKBOOK PAGE: 4-17

**LESSON 5: INTRODUCTION TO MSDSs AND MSDS PHYSICAL
HAZARD INFORMATION**

TRAINER'S NOTES: Introduction and Learning Objectives

Ask trainees to look at the Introduction and Learning Objectives of pages 5-1 and 5-2 of their Student Workbook and emphasize the following:

- MSDSs contain more detailed information than either warning labels or the Hazardous Chemical Inventory.
- How trainees can access the MSDS for chemical materials to which they may be exposed.
- The importance of knowing how to locate and use MSDSs to answer the questions listed on pages 5-1 and 5-2 of their workbook.

Note: *Following Videotape Segment 5A, you can refer trainees to any MSDS and ask them to use it to answer the following questions:*

- ___ Is it a solid, a liquid, or a gas?
- ___ Can I see it?
- ___ Might I smell it?
- ___ How fast does it evaporate?
- ___ How much of it can evaporate?
- ___ How much force does its vapor exert inside a closed container?
- ___ Is it heavier than air or lighter than air?
- ___ Is it heavier than water or lighter than water?
- ___ Is it soluble in water?
- ___ Does it float on water or sink in water?

Similarly, you can use the following questions to provide practice using an MSDS following Videotape Segment 5B:

- ___ Can the chemical cause fires?
- ___ How do I put out a fire?
- ___ Can the chemical explode?
- ___ Is the chemical unstable or reactive?
- ___ What conditions or materials must be avoided?
- ___ How do I clean up a spill or leak?

LESSON 5: INTRODUCTION TO MSDSs AND MSDS PHYSICAL HAZARD INFORMATION

INTRODUCTION

Material Safety Data Sheets (MSDSs) contain a great deal of useful information about chemical hazards. You have a right to review a copy of the MSDS for any chemical material in your work area simply by asking. This lesson helps you understand how to read an MSDS. You will see what kinds of general information and physical data the MSDS contains. Then you will see how to use MSDSs to help protect yourself from physical hazards of the hazardous chemicals in your workplace.

LEARNING OBJECTIVES

When you have completed this lesson, you should be able to do the following:

- ___ Identify general information that must be contained on an MSDS.
- ___ Use physical data on an MSDS to answer the following questions about a chemical material:
 - ___ Is it a solid, a liquid, or a gas?
 - ___ Can I see it?
 - ___ Might I smell it?
 - ___ How fast does it evaporate?
 - ___ How much of it can evaporate?
 - ___ How much force does its vapor exert inside a closed container?
 - ___ Is it heavier than air or lighter than air?
 - ___ Is it heavier than water or lighter than water?
 - ___ Is it soluble in water?
 - ___ Does it float on water or sink in water?
- ___ Use physical data on an MSDS to compare the vapor hazards of liquid chemicals.
- ___ Use MSDS physical hazard information to answer the following questions:
 - ___ Can the chemical cause fires?
 - ___ How do I put out a fire?

STUDENT WORKBOOK PAGE: 5-1

TRAINER'S NOTES: Learning Resources

Videotape Segments 5A and 5B, located on Tape 2

Note: *On VHS or BETA videotapes, all seven segments are on one videotape.*

TRAINER'S NOTES: Directions for Proceeding

Direct trainees to disregard page 5-2 and proceed to page 5-3 of the Student Workbook.

LEARNING OBJECTIVES

Continued

- ___ Can the chemical explode?
- ___ Is the chemical unstable or reactive?
- ___ What conditions or materials must be avoided?
- ___ How do I clean up a spill or leak?

LEARNING RESOURCES

- Videotape Segment 5A: Physical Characteristics Information
- Workbook Application Exercise 5A-1: Understanding General Information and Physical Data on MSDSs
- Workbook Application Exercise 5A-2: Using General Information and Physical Data on MSDSs
- Videotape Segment 5B: Physical Hazard Information
- Workbook Application Exercise 5B-1: Understanding MSDS Physical Hazard Information
- Workbook Application Exercise 5B-2: Using MSDS Physical Hazard Information
- Lesson Summary

DIRECTIONS FOR PROCEEDING

Complete the following steps in order. You might want to check off each step as you complete it.

- ___ 1) Read the workbook introduction to Videotape Segment 5A.
- ___ 2) Watch Videotape Segment 5A.
- ___ 3) Complete Application Exercise 5A-1 in this workbook.
- ___ 4) Complete Application Exercise 5A-2 in this workbook.
- ___ 5) Read the workbook introduction to Videotape Segment 5B.
- ___ 6) Watch Videotape Segment 5B.
- ___ 7) Complete Application Exercise 5B-1 in this workbook.
- ___ 8) Complete Application Exercise 5B-2 in this workbook.
- ___ 9) Read the lesson summary.

STUDENT WORKBOOK: 5-2

TRAINER'S NOTES: Introduction to Videotape Segment 5A

Note: *Ask trainees to look at the videotape introduction on page 5-3 of the Student Workbook.*

Inform trainees that we're going to cover each section of the MSDS separately.

- As we watch this videotape, notice —
 - the kinds of general information contained in the first section of the MSDS; and
 - how you can use the information contained in the Physical Data Section to recognize chemical materials, vapor hazards, and special fire hazards.

INTRODUCTION TO VIDEOTAPE SEGMENT 5A:
Physical Characteristic Information

Every MSDS must contain certain kinds of information about the organization that prepared the document, the identity of the chemical material, and the material's physical properties.

As you watch this videotape segment, look for the kinds of general information that the MSDS must contain. Pay particular attention to the information included in the Physical Data Section. Notice how this data can help you recognize chemical materials, vapor hazards, and special fire hazards.

Now, watch Videotape Segment 5A.

TRAINER'S NOTES: Application Exercise 5A-1

Ask trainees to turn to page 5-5 of their Student Workbook. Either lead the class through Application Exercise 5A-1 as a group activity, or provide time for students to complete the exercise individually or in small groups. The answers and additional information given below appear on pages 5-6, 5-8, and 5-10 of the Student Workbook.

Answer	Additional Information
1) A B C	<p>Every MSDS must contain the name, address, and telephone number of the party responsible for preparing the document.</p> <p>OSHA requires this information so that you can easily contact the responsible party.</p>
2) A	<p>One name on the MSDS must be the same as the name used on the label and the Hazardous Chemical Inventory in your workplace. But many chemical materials have more than one name. So, you may also see synonyms or trade names. The MSDS may also tell you that the material belongs to a chemical family or has a particular chemical structure. Section (g)(2) of the Hazard Communication Standard (29 CFR 1910.1200) contains very specific requirements for identifying chemicals on the MSDS.</p>
3) B	<p>Mixtures contain more than one ingredient. If the material is a mixture, the MSDS must identify all the hazardous ingredients.</p> <p>Paints, preservatives, solvents, alloys, and metallic coatings are common mixtures, but any solid, liquid, or gas can be a mixture.</p>

APPLICATION EXERCISE 5A-1:
Understanding General Information and Physical Data on MSDSs

Directions: Check or circle your answer(s) to each question, or write your answer in the blank provided. Remember, there may be more than one correct choice for a question. When you complete the exercise, fold over the right side of the page to check your answers. Then turn the page to get more information about each question.

- 1) What information must the MSDS contain about the party who prepared the document?
 - A) Name
 - B) Address
 - C) Phone number

- 2) Can an MSDS include more than one name for a chemical material?
 - A) Yes
 - B) No

- 3) If the chemical material is a mixture, what must the MSDS identify?
 - A) Paints or coatings that are safe to use with it
 - B) Name of each hazardous ingredient
 - C) Other similar mixtures of liquids, solids, or gases

Answer Additional Information

- 4) B Evaporation rates are reported as comparisons. The evaporation rate tells you **HOW FAST** a liquid evaporates compared to water, in this case, the standard, which has an evaporation rate of one. That is, it tells you how quickly vapors get into the air from an exposed liquid surface.

Evaporation Rate (Water = 1)	Meaning
Less than 1 (<1)	Vaporizes <i>SLOWER</i> than water
1	<i>SAME</i> rate as water
More than 1 (>1)	Vaporizes <i>FASTER</i> than water

- 5) A, B, D Vapor forms above the liquid surface inside a closed container. This vapor exerts a force on the walls of the container. The force is the vapor pressure of the liquid.

Like air pressure, vapor pressure is measured in millimeters of mercury (mm Hg). Vapor pressure increases as the temperature of a liquid rises.

Liquids with high vapor pressures at room temperature (greater than about 100 mm Hg) present a special hazard. The pressure inside a sealed container can make the container swell or burst open. This releases a hazard and is most likely to happen if a sealed container is exposed to heat.

Given a closed room, vapor pressure can tell you how much liquid will evaporate.

High vapor pressure will tell you how fast it gets into the air, as well.

4) Which chemical gets into the air faster?

A) Evaporation Rate 0.35
(Water = 1)

B) Evaporation Rate 3.5
(Water = 1)

5) What does vapor pressure tell you?

- A) How fast a chemical gets into the air.
- B) How much of the chemical can evaporate.
- C) Whether the vapor is lighter or heavier than air.
- D) How much force the vapor exerts inside a closed container.

Answer Additional Information

- 6) B Vapor density tells you whether a vapor is lighter than air or heavier than air, which has a density of 1.

Vapor Density (Air = 1)	Meaning
Less than 1 (<1)	<i>LIGHTER</i> than air. Tends to <i>RISE</i> , and get out of your breathing zone.
Greater than 1 (>1)	<i>HEAVIER</i> than air. Tends to <i>SINK</i> , stay in your breathing zone, and accumulate in low spots.

Note: *If the air around the vapor is turbulent (breezy), the vapor may mix with air and become close to 1.*

- 7) A Specific gravity tells you whether a liquid is lighter than water or heavier than water, which has a specific gravity of 1.

Specific Gravity (Water = 1)	Meaning
Less than 1 (<1)	<i>LIGHTER</i> than water. <i>FLOATS</i> if not soluble in water.
Greater than 1 (>1)	<i>HEAVIER</i> than water. <i>SINKS</i> if not soluble in water.

Note: *Direct trainees either to proceed to Application Exercise 5A-2 when finished, or to wait for further instructions. If time allows, ask the Optional Questions that begin on page 5-14 of this guide.*

6) Which vapor tends to sink in still air?

A) Vapor Density 0.80
(Air = 1)

B) Vapor Density 1.52
(Air = 1)

7) Which liquid is lighter than water?

A) Specific Gravity 0.60
(Water = 1)

B) Specific Gravity 1.80
(Water = 1)

Now go back to page 5-5, fold over the right side of the page, and check your answers. Look on the back of the question page for more information on each question. If you are taking this course as a self-study, proceed to Application Exercise 5A-2, "Using General Information and Physical Data on MSDSs," when you have finished. If you are taking this course in a classroom situation, wait for further instructions from your trainer when finished.

TRAINER'S OPTIONAL QUESTIONS: Application Exercise 5A-1 Continued

O1) Write the following *BOILING POINTS* shown on the chalkboard and ask:

Which chemicals are gases at room temperature?

- A) 15°F B) 110°F C) - 80°F D) 250°F

Answer: A, C

Gases have boiling points *BELOW* room temperature, which is about 68°F. Many gases have boiling points well below zero. In that case, the boiling point has a minus sign in front of it.

A boiling point of - 80° F means that the material changes from a liquid to a gas at 80° *BELOW* 0°F.

O2) List choices and ask trainees: What information do you need to tell if a liquid floats on water?

- A) Specific gravity
- B) Vapor density
- C) Solubility in water
- D) Appearance and odor

Answer: A, C; Specific gravity, water solubility

To float on water, a liquid must be lighter than water (specific gravity less than 1). It must also have little or no solubility in water.

Water *SPREADS* fire involving burning liquids that float on water — water does *NOT* put out fires involving such liquids.

STUDENT WORKBOOK: No Reference

TRAINER'S NOTES: Application Exercise 5A-2

Ask trainees to turn to page 5-11 of their Student Workbook. Either lead the class through Application Exercise 5A-2 as a group activity, or provide time for students to complete the exercise individually or in small groups. The answers and additional information given below appear on pages 5-12 and 5-14 of the Student Workbook.

Do one of the following:

- Refer trainees to the appropriate Appendix in their workbook and ask each question as is.*
 - Tailor the activity to your facility by handing out or projecting MSDSs for several commonly used chemical materials in your facility and asking questions similar to questions 1 through 4.*
-

Answer	Additional Information
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	The MSDS for Automatic Transmission Fluid is located on pages A-4 to A-5 in Appendix A.
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1) A	Section 1 of the MSDS gives you an emergency telephone number to call for assistance. Calling this number is usually the fastest way to get the answers you need in an emergency situation. This puts you in immediate contact with the manufacturer or party responsible for preparing the MSDS. Writing for answers only works when you can afford to wait for the information.
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Most physicians know little or nothing about transmission fluid. With hundreds of thousands of chemical materials in use, you cannot expect OSHA to have specific information about any one product.

2) A	Look at Section 2 of the MSDS. It lists three ingredients: refined oils, anti-oxidant, and dye. Any material that contains two or more different ingredients is a mixture.
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APPLICATION EXERCISE 5A-2:
Using General Information and Physical Data on MSDSs

Directions: Check or circle your answer(s) to each question, or write your answer in the blank provided. Remember, there may be more than one correct choice for a question. When you complete the exercise, fold over the right side of the page to check your answers. Then turn the page to get more information about each question.

Locate the MSDS for Automatic Transmission Fluid in Appendix A and use it to answer the following questions.

- 1) What should you do if you need more information about Automatic Transmission Fluid in an emergency situation?
 - A) Call 318-555-5214
 - B) Call a doctor
 - C) Write PO Box 3758, Anytown, OK 74000
 - D) Write OSHA

- 2) Is this transmission fluid a mixture?
 - A) Yes
 - B) No

Answer	Additional Information
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3) B	Look at the APPEARANCE & ODOR information in the Physical and Chemical Characteristics Section, Section 3. It tells you that the material is a red, oily liquid.
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4) A, B	Again, look at the APPEARANCE & ODOR information in Section 3. It tells you that the material is a red, oily liquid. You can see the liquid, but you probably cannot see the vapor or mist that can be formed from the liquid. The MSDS also tells you that this transmission fluid has a slightly oily odor. This means you can smell it, but the odor is faint. So you may not notice the smell — especially if the air you are breathing contains only small amounts of vapor.
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Note: *Direct trainees either to read the introduction to Videotape Segment 5B when finished, or to wait for further instructions. If time allows, ask the Optional Questions that begin on page 5-20 of this guide.*

3) What is the material's physical form?

- A) Solid
- B) Liquid
- g) Gas

4) How might you sense release of this transmission fluid in your workplace?

- A) See it
- B) Smell it
- C) Can't sense it — chemical is invisible and odorless

Now go back to page 5-11, fold over the right side of the page, and check your answers. Look on the back of the question page for more information on each question. If you are taking this course as a self-study, read the introduction to Videotape Segment 5B when you have finished. If you are taking this course in a classroom situation, wait for further instructions from your trainer when finished.

TRAINER'S OPTIONAL QUESTIONS: Application Exercise 5A-2

Do one of the following:

- *Refer trainees to the MSDS for Automatic Transmission Fluid in Appendix A (pages A-4 to A-5) of their Student Workbook and ask questions O1 to O5.*
 - *Tailor the activity to your facility by handing out or projecting MSDSs for several commonly used chemical materials in your facility and ask questions similar to questions O1 to O9. Notice that optional questions O6 through O9 require comparing the MSDSs for two different materials.*
-

O1) In what physical forms can this material become airborne?

Answer: Vapor, Mist

Liquids become airborne as vapors and mists.

Also notice that Section 6 of the MSDS gives health effects associated with exposure to vapors and mists of this material.

O2) Does the vapor tend to sink in air or rise in air?

Answer: Sink

Look at **VAPOR DENSITY** in Section 3. It says whether the vapor is heavier than air (> 1 = density greater than 1) or lighter than air (< 1 = density less than 1). In this case, the MSDS reports that the vapor density is > 1 , which means **GREATER THAN 1**. Because the vapor is more dense than air, it tends to sink in air.

STUDENT WORKBOOK: No Reference

TRAINER'S OPTIONAL QUESTIONS: Application Exercise 5A-2 Continued

O3) Is this transmission fluid lighter than water?

Answer: Yes

Look at the *SPECIFIC GRAVITY* given in Section 3. It tells you whether the material is lighter than water (specific gravity less than 1) or heavier than water (specific gravity greater than 1). This transmission fluid has a specific gravity of 0.87, which means it is lighter than water.

O4) Does this transmission fluid float on water?

Answer: Yes

Look at the *SPECIFIC GRAVITY* and the *SOLUBILITY IN WATER*, which are both given in the Physical and Chemical Characteristics Section. Materials that float on water have a specific gravity less than 1 and little or no solubility in water.

This transmission fluid floats on water because it has a specific gravity of 0.87 and negligible solubility in water.

O5) Does this transmission fluid present a vapor pressure hazard when stored inside a sealed container?

Answer: No

Look at the *VAPOR PRESSURE* given in the Physical and Chemical Characteristics Section. Vapor pressure tells you how much force the vapor exerts inside a closed container.

This transmission fluid has a low vapor pressure, 2.7 mm Hg. Thus, it does not present a vapor pressure hazard when stored inside a sealed container. Materials having vapor pressures above 100 mm Hg are especially hazardous.

Refer trainees to the MSDS for methanol (pages A-8 to A-9) and 732 Sealant (pages A-10 to A-11) in Appendix A of their Student Workbook and ask questions O6 through O9.

STUDENT WORKBOOK: No Reference

TRAINER'S OPTIONAL QUESTIONS: Application Exercise 5A-2 Continued

O6) Which chemical material becomes airborne faster?

Answer: Methanol

Compare the *EVAPORATION RATES* given in the Physical and Chemical Characteristics Section, Section 3. These rates tell you how fast the material evaporates in comparison to butyl acetate (the standard in this case), which equals 1.

Methanol has an evaporation rate of 5.9, whereas the sealant has an evaporation rate of less than 1. Both are compared to butyl acetate. Thus, methanol becomes airborne faster than the sealant.

O7) Which chemical material exerts more force on the inside of a sealed container?

Answer: Methanol

Compare the *VAPOR PRESSURES* given in Section 3. The higher the vapor pressure, the more force the vapor exerts on the inside of a sealed container.

Methanol exerts more force than the sealant because methanol has a vapor pressure of 97.3 mm Hg, whereas the sealant has a vapor pressure of less than 5 mm Hg. Notice that Section 4 of the MSDS for methanol tells you that containers heated by fire can explode. This hazard is caused by methanol's high vapor pressure. Note, however, that any container holding liquid may explode when heated, even one with water.

O8) Overall, which chemical material becomes airborne more easily?

Answer: Methanol

Compare *VAPOR PRESSURE AND EVAPORATION RATE* in the Section 3.

Methanol becomes airborne more easily than the sealant because it has a higher vapor pressure (97.3 mm Hg for methanol versus <5 mm Hg for sealant) and it evaporates more quickly (rate 5.9 versus <1 for sealant).

STUDENT WORKBOOK: No Reference

TRAINER'S OPTIONAL QUESTIONS: Application Exercise 5A-2 Continued

O9) Which chemical material is more soluble in water?

Answer: Methanol

Compare *SOLUBILITY IN WATER* given in the Physical and Chemical Characteristics Section.

Methanol is completely soluble in water. The sealant has a solubility of 0.1 g per 100 g of water, but it is not completely soluble as methanol is.

STUDENT WORKBOOK: No Reference

TRAINER'S NOTES: Introduction to Videotape Segment 5B

Note: *Ask trainees to look at the videotape introduction on page 5-15 of the Student Workbook.*

■ As we watch this videotape, you should learn to use MSDS Physical Data Sections to help —

- identify and control explosion hazards, fire hazards, and reactivity hazards;
- clean up chemical spills and leaks; and
- dispose of chemical wastes properly.

INTRODUCTION TO VIDEOTAPE SEGMENT 5B:
Physical Hazard Information

You have seen that physical hazards include explosion hazards, fire hazards, and unstable or reactive chemicals. The MSDS identifies these types of hazards and provides information to help you control them.

As you watch this videotape, look for the kinds of information contained in the Fire and Explosion Hazard Data Section of the MSDS, and learn how to identify these hazards. Learn to use the Reactivity Data Section to identify unstable or reactive chemicals, and watch for ways of preventing hazardous reactions in the workplace. Finally, notice how the Precautions for Safe Handling and Use Section helps you clean up chemical spills or leaks correctly and dispose of the chemical waste properly.

Now, watch Videotape Segment 5B.

TRAINER'S NOTES: Application Exercise 5B-1

Ask trainees to turn to page 5-17 of their Student Workbook. Either lead the class through Application Exercise 5B-1 as a group activity, or provide time for students to complete the exercise individually or in small groups. The answers and additional information given below appear on page 5-18 of the Student Workbook.

Answer	Additional Information
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- | | |
|------------|---|
| 1) A | <p>The flash point is the lowest temperature at which a liquid gives off enough vapor to ignite in the presence of an ignition source, such as a match, spark, or cigarette.</p> <p><i>FLAMMABLE</i> liquids have flash points below 100°F.</p> <p><i>COMBUSTIBLE</i> liquids have flash points at or above 100°F.</p> |
| 2) A, B, C | <p>The Reactivity Data Section of the MSDS lists conditions to avoid for unstable chemicals and polymerization hazards and incompatible reactions or materials. The conditions to avoid are those that might cause the chemical to decompose (break down into simpler molecules), or to polymerize (self-react to form larger molecules).</p> |
| 3) C | <p>Reactive chemicals become hazardous when in contact with certain other chemical materials. Contact may cause a fire, explosion, or other violent chemical reaction. It may also produce or release a hazardous chemical.</p> <p>For this reason, the Reactivity Data Section lists materials to avoid for reactive chemicals.</p> |

Note: *Direct trainees either to proceed to Application Exercise 5B-2 when finished, or to wait for further instructions. If time allows, ask the Optional Questions that begin on page 5-32 of this guide.*

APPLICATION EXERCISE 5B-1:
Understanding MSDS Physical Hazard Information

Directions: Check or circle your answer(s) to each question, or write your answer in the blank provided. Remember, there may be more than one correct choice for a question. When you complete the exercise, fold over the right side of the page to check your answers. Then turn the page to get more information about each question.

1) Which chemical material is flammable?

A)

Flash Point	70°F
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B)

Flash Point	150°F
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2) For which materials must the MSDS list *CONDITIONS* to avoid?

A) Unstable chemicals

B) Reactive chemicals

C) Polymerization hazards

3) If the MSDS lists *MATERIALS* to avoid, what kind of hazard is the chemical?

A) Unstable

B) Flammable

C) Reactive

D) Combustible

Now fold over the right side of the page, and check your answers. Look on the back of the question page for more information on each question. If you are taking this course as a self-study, continue to Application Exercise 5B-2, "Using MSDS Physical Hazard Information," when you have finished. If you are taking this course in a classroom situation, wait for further instructions from your trainer when finished.

STUDENT WORKBOOK PAGE: 5-17

TRAINER'S OPTIONAL QUESTIONS: Application Exercise 5B-1

O1) What is the upper limit of the flash point for a combustible material?

Answer: 200°F

All flammable and combustible liquids have the following in common.

- Flash point below 200°F
- Fire hazards

In general, materials with lower flash points are more hazardous than materials with higher flash points.

O2) Draw the following chart on the chalkboard and ask: Which *TWO* chemical materials have the greatest potential for explosion?

	LEL	UEL
A)	5%	15%
B)	20%	30%
C)	20%	80%
D)	80%	98%

Answer: A, C

Materials with a *LOW LEL* (A) are extremely explosive because very little vapor needs to become airborne to form an explosive mixture.

Materials with a *WIDE EXPLOSIVE RANGE* (C) are also very dangerous because airborne vapors explode in almost any combination with air.

STUDENT WORKBOOK: No Reference

TRAINER'S OPTIONAL QUESTIONS: Application Exercise 5B-1 Continued

O3) *List choices and ask trainees:* What information tells you about toxic gases or vapors formed when a material breaks down into simpler chemicals?

- A) Incompatibility
- B) Waste disposal method
- C) Extinguishing media
- D) Hazardous decomposition products

Answer: D

Some unstable chemicals decompose or break down into simpler chemicals under commonly occurring conditions. Other chemicals decompose when heated or burned.

In either case, the Reactivity Data Section must list any known hazardous decomposition products, such as toxic vapors or gases.

O4) *List choices and ask trainees:* Which section of the MSDS identifies proper waste disposal methods?

- A) Fire and Hazard Explosion Data
- B) Reactivity Data
- C) Precautions for Safe Handling and Use

Answer: C

The Precautions for Safe Handling and Use Section of the MSDS provides two vital kinds of information —

- Steps to take if the material is released or spilled; and
- Proper waste disposal method.

Cleaning up a spill or leak properly is vital because using incorrect procedures can make the situation worse, create new hazards, and jeopardize health or safety.

Strict government regulations apply to the disposal of most chemical wastes. Disposing of even a small amount of chemical waste improperly can injure people, contaminate the water supply, or harm the environment.

STUDENT WORKBOOK: No Reference

TRAINER'S NOTES: Application Exercise 5B-2

Ask trainees to turn to page 5-19 of their Student Workbook. Either lead the class through Application Exercise 5B-2 as a group activity, or provide time for students to complete the exercise individually or in small groups. The answers and additional information given below appear on page 5-20 of the Student Workbook.

Do one of the following:

- Refer trainees to the MSDS for Crystal Clear in Appendix A (pages A-2 to A-3) of their workbook and ask each question as is.*
- Tailor the activity to your facility by handing out or projecting MSDSs for several commonly used chemical materials in your facility and asking questions similar to questions 1 through 3.*

Answer	Additional Information
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The MSDS for Crystal Clear is located on pp. A-2 to A-3 of Appendix A.

1) A, B, D

Look at the Fire and Explosion Hazard Data given in Section 4 of the MSDS. Crystal Clear is a fire hazard because it contains a flammable gas. It's an explosion hazard because explosive limits (LEL and UEL) are given.

The Reactivity Data in Section 5 of the MSDS tells you that Crystal Clear is stable, and that it does not undergo hazardous polymerization. It also tells you two kinds of materials to avoid — corrosives and active metals. Whenever the MSDS lists materials to avoid, the chemical is reactive.

2) A, B

Look at the MATERIALS TO AVOID listed in the Reactivity Data Section. It tells you to keep Crystal Clear away from corrosives and active metals, such as aluminum and magnesium. Whenever the MSDS lists Materials to Avoid, it means that contact with these materials can produce or release a hazard.

3) A

Look at the HAZARDOUS DECOMPOSITION PRODUCTS listed in the Reactivity Data Section. All four chemicals listed are toxic gases formed when Crystal Clear burns or decomposes. Carbon monoxide, phosgene and hydrogen chloride are deadly.

APPLICATION EXERCISE 5B-2: Using Physical Data on MSDSs

Directions: Check or circle your answer(s) to each question, or write your answer in the blank provided. Remember, there may be more than one correct choice for a question. When you complete the exercise, fold over the right side of the page to check your answers. Then turn the page to get more information about each question.

Locate the MSDS for Crystal Clear in Appendix A and use it to answer the following questions.

- 1) What type(s) of physical hazards does Crystal Clear present?
 - A) Fire
 - B) Explosion
 - C) Unstable
 - D) Reactive
 - E) Polymerization

 - 2) Crystal Clear produces a hazardous situation when it comes in contact with ____:
 - A) Corrosives
 - B) Certain metals
 - C) Water
 - D) Air

 - 3) Does Crystal Clear produce any hazards when it burns or breaks down into simpler chemicals?
 - A) Yes
 - B) No
- _____

Now fold over the right side of the page, and check your answers. Look on the back of the question page for more information on each question. If you are taking this course as a self-study, proceed to the Lesson Summary when you have finished. If you are taking this course in a classroom situation, wait for further instructions from your trainer when finished.

Note: *Direct trainees either to proceed to the Lesson Summary when finished, or to wait for further instructions. If time allows, ask the Optional Questions that begin on page 5-40 of this guide.*

STUDENT WORKBOOK: No Reference

TRAINER'S OPTIONAL QUESTIONS: Segment 5B-2

Do one of the following:

- *Refer trainees to the MSDS for Crystal Clear in Appendix A (pages A-2 through A-3) of their workbook and ask each question as is.*
 - *Tailor the activity to your facility by handing out or projecting MSDSs for several commonly used chemical materials in your facility and ask questions similar to questions O1 to O5. Notice that optional question O5 requires comparing the MSDSs for two different materials.*
-

O1) *List choices and ask trainees:* What should be done if a fire breaks out in the vicinity of closed containers of Crystal Clear?

- A) Vent closed containers
- B) Cool closed containers
- C) Move closed containers
- D) No special actions required

Answer: B

If trainees discover a fire in the vicinity of Crystal Clear (or anywhere for that matter), they should call for help and clear the area unless they have been trained to fight fires.

The trained firefighters should be familiar with Section 4 of the MSDS, **SPECIAL FIREFIGHTING PROCEDURES**. It says that closed containers of Crystal Clear are under pressure and can explode when heated. To prevent explosion the containers should be cooled with a water stream. Trainees should do so only if they have been properly trained how to.

Venting the containers would be extremely hazardous because Crystal Clear is both flammable and explosive in air. Because of the pressure build-up and explosion hazard, handling or moving hot containers in a fire situation also presents an extreme risk to safety and health.

STUDENT WORKBOOK: No Reference

O2) *List choices and ask trainees:* Which conditions are hazardous?

- A) Light
- B) Shock
- C) Heat
- D) Sparks

Answer: C, D

Look at the **CONDITIONS TO AVOID** given in the Reactivity Data Section, Section 5 of the MSDS. It says to avoid temperatures greater than 120°F.

All flammable materials must be kept away from ignition sources, such as sparks. The Precaution for Safe Handling and Use Section of the MSDS, Section 7, reminds users of this general rule.

O3) *List choices and ask trainees:* What should you do if you spill Crystal Clear?

- A) Ventilate the area with an electric fan
- B) Mop it up
- C) Wash it down the nearest drain
- D) Use an absorbent to soak it up

Answer: D

Look at the **STEPS TO BE TAKEN IN CASE OF RELEASE OR SPILL** given in Section 7 of the MSDS. The MSDS says to use an absorbent to soak up the material. It also says to ventilate **AND** to remove ignition sources. Thus, an electric fan should not be used because operating electrical equipment can produce sparks that might ignite the spilled material.

Trainees should never mop up spills of hazardous liquids. Nor should they dispose of chemicals by pouring or washing them down the drain. Such practices can injure people, contaminate the water supply, damage the environment, start fires, or subject trainees to possible legal actions.

STUDENT WORKBOOK: No Reference

O4) *List choices and ask trainees:* What is the proper method for disposing of waste containing Crystal Clear?

- A) Incinerate it
- B) Bury it in a landfill
- C) Consult government regulations
- D) Waste not hazardous — no special procedure required

Answer: C

Look at the WASTE DISPOSAL METHOD given in the Precautions for Safe Handling and Use Section of the MSDS. It says to follow government regulations when disposing of Crystal Clear waste. The correct disposal method may be to incinerate or bury it, but state and federal regulations must be checked to find this out.

All hazardous chemical materials, including Crystal Clear, produce hazardous chemical waste.

Refer trainees to the MSDSs for Gasoline (page A-12) and for Stainless Steel Cleaner and Polish (page A-14) in Appendix A of their workbook and ask question O5.

O5) Which material presents the greater fire hazard?

Answer: Gasoline

Compare the FLASH POINTS given in the Fire and Explosion Hazard Data Section, Section 4 of the MSDS. The material with the lower flash point presents the greater fire hazard.

Gasoline has a lower flash point (- 45°F) than the cleaner (0°F). However, both materials have very low flash points and are extremely flammable.

STUDENT WORKBOOK: No Reference

TRAINER'S NOTES: Review of Videotape Segment 5A

If time permits, review and reinforce the learning objectives by asking the questions suggested below. Draw trainees' attention to the tables in the Summary of the Student Workbook. Point out that the tables summarize how to read and use the sections of the MSDS covered thus far.

Note: Make sure that you actually provide practice using MSDSs.

Q1) What general information must every MSDS contain (usually in the first section)?

Answer: Every MSDS must contain the following general information.

- Name, address, and telephone number of the party responsible for preparing or distributing the MSDS, who can provide additional information on the hazardous chemical and appropriate emergency procedures.
- Name of the chemical material as it appears on the warning label and Hazardous Chemical Inventory in your workplace. Section (g)(2) of the Hazard Communication Standard (29 CFR 1910.1200) contains very specific requirements for identifying chemicals on the MSDS.
- Health hazards of the chemical, including signs and symptoms of exposure.
- Precautions for safe handling and use.
- Any applicable control measures.

Q2) What is a mixture? What information must the MSDS provide about mixtures?

Answer: Many chemical materials are mixtures. Mixtures contain more than one ingredient. The MSDS must identify *ALL* hazardous ingredients in a mixture.

Q3) What types of liquids float on water?

Answer: Liquids that are not soluble in water either float (specific gravity less than 1) or sink (specific gravity greater than 1). Liquids that float on water present a special fire hazard. Water does not stop such liquids from burning. Instead, water spreads the fire.

LESSON 5 SUMMARY

Every MSDS must contain the following general information.

- Name, address, and telephone number of the party responsible for preparing or distributing the MSDS, who can provide additional information on the hazardous chemical and appropriate emergency procedures.
- Name of the chemical material as it appears on the warning label and Hazardous Chemical Inventory in your workplace.
- Health hazards of the chemical, including signs and symptoms of exposure.
- Precautions for safe handling and use.
- Any applicable control measures.

Many chemical materials are mixtures. Mixtures contain more than one ingredient. The MSDS must identify *ALL* hazardous ingredients in a mixture.

The following table summarizes the information you will find in the **Physical Data Section** of the MSDS.

Physical Data	Question Answered	Explanation
APPEARANCE AND ODOR	Solid, liquid, or gas? What does it look like? Can I see/smell it?	MSDS describes physical form/appearance, color, and odor (if any).
BOILING POINT	Is it a gas?	YES if boiling point is BELOW room temperature
EVAPORATION RATE (STANDARD = 1)	How FAST does it evaporate?	FASTER than standard if rate GREATER than 1. SLOWER than standard if rate LESS than 1.
VAPOR PRESSURE (mm Hg)	How much FORCE does the vapor exert inside a closed container?	Higher is more hazardous. Over 100 mm Hg may cause container to burst open upon exposure to heat.
VAPOR DENSITY (Air = 1)	Is it heavier than air or lighter than air?	HEAVIER if GREATER than 1. LIGHTER if LESS than 1.
SPECIFIC GRAVITY (Water = 1)	Is it heavier than water or lighter than water?	HEAVIER if GREATER than 1. LIGHTER if LESS than 1.
SOLUBILITY IN WATER	Is it soluble in water?	NO if solubility none or a number near zero.

STUDENT WORKBOOK PAGE: 5-21

TRAINER'S NOTES: Review of Videotape Segment 5B

Q1) Which sections of the MSDS contain physical hazard information?

Answer: Physical hazard information appears in the —

- Fire and Explosion Hazard Data Section
- Reactivity Data Section; and
- Precautions for Safe Handling and Use

Q2) *If time permits, provide practice using the tables contained on pages 5-22 and 5-23 of the Student Workbook by asking questions such as:*

- What information tells you whether you can see or smell the material?

Answer: Appearance and odor.

- What does evaporation rate tell you?

Answer: How fast it evaporates.

- What does a specific gravity greater than 1 tell you?

Answer: The material is heavier than water.

Liquids that are not soluble in water either float (specific gravity less than 1) or sink (specific gravity greater than 1). Liquids that float on water present a special fire hazard. Water does not stop such liquids from burning. Instead, water spreads the fire.

Physical hazard information appears in the following sections of the MSDS.

- Fire and Explosion Hazard Data section
- Reactivity Data section
- Precautions for Safe Handling and Use section

The following table summarizes the information you will find in the **Fire and Explosion Hazard Data Section** of the MSDS.

Data	Question Answered	Explanation
FLASH POINT	Is it a fire hazard? Is it flammable? Is it combustible?	YES if below 200°F. YES if below 100°F. YES if 100-200°F. Lower is more hazardous.
LEL and UEL	Can it explode in air?	YES if limits given. Low LEL or wide explosive range most hazardous.
EXTINGUISHING MEDIA	What material should be used to put out a fire?	Use protective equipment and special procedures given.
SPECIAL FIRE FIGHTING PROCEDURES	How should firefighters put out a fire?	Use protective equipment and special procedures given.
UNUSUAL FIRE AND EXPLOSION HAZARDS	Is it a fire hazard? Can it explode?	YES if any information is given in either category.

Do **NOT** attempt to put out a chemical fire unless you have been specially trained to do so. Instead, sound the alarm and leave the area.

TRAINER'S NOTES

LESSON 5 SUMMARY**Continued**

The following table summarizes the information you will find in the **Reactivity Data Section** of the MSDS.

Data	Question Answered	Explanation
STABILITY	Is it unstable? What conditions should be avoided?	YES if "Unstable" checked. Conditions to avoid are listed.
INCOMPATIBILITY	Is it reactive? What materials should be avoided?	YES if information given. Materials to avoid are listed.
HAZARDOUS DECOMPOSITION PRODUCTS	Does it produce or release a hazard when it decomposes?	YES if any products are listed.
HAZARDOUS POLYMERIZATION	Can it occur? What conditions should be avoided?	YES if "May Occur" checked. Conditions to avoid are listed.

The following table summarizes the information you will find in the **Precautions for Safe Handling and Use Section** of the MSDS.

Data	Question Answered	Explanation
STEPS TO BE TAKEN IF MATERIAL IS SPILLED OR RELEASED	How do I clean up a spill or leak?	Follow specific steps and procedures given.
WASTE DISPOSAL METHOD	What is the proper waste disposal method?	Follow specific methods given and refer to any government regulations.

LESSON 6: MSDS HEALTH HAZARD INFORMATION

TRAINER'S NOTES: Introduction and Learning Objectives

Ask trainees to look at the Introduction and Learning Objectives of page 6-1 of their Student Workbook and emphasize the following:

- In addition to physical hazard information, Material Safety Data Sheets contain a great deal of information about health hazards.
- In this lesson, you'll see how you can use the MSDS to identify —
 - Health hazards;
 - Exposure routes;
 - Health effects;
 - First-aid procedures;
 - Required protective equipment; and
 - Special handling and storage precautions.

Note: *As in Lesson 5, you can provide practice using MSDSs following Videotape Segment 6 by projecting or handing one out and asking the following questions:*

- ___ Is it a health hazard?
- ___ What is the exposure limit?
- ___ How can I be exposed?
- ___ What can it do to me?
- ___ What first-aid procedures should I use?
- ___ What protective equipment is required?
- ___ What special precautions should I take?

LESSON 6: MSDS HEALTH HAZARD INFORMATION

INTRODUCTION

In addition to physical hazard information, Material Safety Data Sheets contain a great deal of information about health hazards. In this lesson, you'll see how you can use the MSDS to identify the following:

- Health hazards
- Exposure routes
- Health effects
- First-aid procedures
- Required protective equipment
- Special handling and storage precautions

LEARNING OBJECTIVES

When you have completed this lesson, you should be able to do the following:

- ___ Describe different types of exposure limits.
- ___ Use health hazard data on an MSDS to answer the following questions about a chemical material:
 - ___ Is it a health hazard?
 - ___ What is the exposure limit?
 - ___ How can I be exposed?
 - ___ What can it do to me?
 - ___ What first-aid procedures should I use?
 - ___ What protective equipment is required?
 - ___ What special precautions should I take?

TRAINER'S NOTES: Learning Resources

Videotape Segment 6, located on Tape 2

Note: *On VHS or BETA videotapes, all seven segments are on one videotape.*

TRAINER'S NOTES: Directions for Proceeding

Direct trainees to disregard page 6-2 and proceed to page 6-3 of the Student Workbook.

LEARNING RESOURCES

- Videotape Segment 6: Health Hazard Information
- Workbook Application Exercise 6-1: Understanding MSDS Health Hazard Information
- Workbook Application Exercise 6-2: Using MSDS Health Hazard Information
- Lesson Summary

DIRECTIONS FOR PROCEEDING

Complete the following steps in order. You might want to check off each step as you complete it.

- ___ 1) Read the workbook introduction to Videotape Segment 6.
- ___ 2) Watch Videotape Segment 6.
- ___ 3) Complete Application Exercise 6-1 in this workbook.
- ___ 4) Complete Application Exercise 6-2 in this workbook.
- ___ 5) Read the lesson summary.

TRAINER'S NOTES: Introduction to Videotape Segment 6

Note: *Ask trainees to look at the videotape introduction on page 6-3 of the Student Workbook.*

- As we watch this videotape, learn how to use the MSDS to —
 - identify different types of health hazards;
 - find out about exposure limits;
 - recognize exposure symptoms;
 - help a coworker in a medical emergency; and
 - help control health hazards.

INTRODUCTION TO VIDEOTAPE SEGMENT 6:
MSDS Health Hazard Information

As you watch this videotape segment, first watch for the description of exposure limits. Then notice how you can use the MSDS to recognize carcinogens, exposure routes, and medical symptoms. Also pay close attention to the importance of knowing and using the correct first-aid procedures in a medical emergency. Finally, learn how the MSDS helps protect you from health hazards by specifying particular types of protective equipment required and special handling and storage precautions.

Now, watch Videotape Segment 6.

TRAINER'S NOTES: Application Exercise 6-1

Ask trainees to turn to page 6-5 of their Student Workbook. Either lead the class through Application Exercise 6-1 as a group activity, or provide time for students to complete the exercise individually or in small groups. The answers and additional information given below appear on pages 6-6 and 6-8 of the Student Workbook.

Answer	Additional Information
---------------	-------------------------------

- | | |
|------------|--|
| 1) A, B, D | Exposure limits define the amount of chemical allowed in a given volume of air. Limits are set to define airborne levels that produce no ill health effects in most people, even if they are exposed every day for their entire working lives. |
|------------|--|

If an exposure limit has been set, it means that the chemical is a health hazard. It also means that the chemical can become airborne, and that breathing too much of it can injure you or make you sick.

Many chemicals — not just carcinogens — have exposure limits. Often, you cannot see or smell an airborne hazard even when it is present above its exposure limit.

- | | |
|------|--|
| 2) C | OSHA sets <i>Permissible Exposure Limits</i> , or PELs. Compliance with PELs is mandatory. |
|------|--|

Compliance with other exposure limits is voluntary.

- ACGIH (American Conference of Governmental Industrial Hygienists) recommends *Threshold Limit Values*, or TLVs.
- NIOSH (National Institute of Occupational Safety and Health) proposes *Recommended Exposure Limits*, or RELs.
- ANSI (American National Standards Institute) recommends limits set by a consensus of experts.
- Chemical manufacturers may recommend their own exposure limits.

APPLICATION EXERCISE 6-1:
Understanding MSDS Health Hazard Information

Directions: Check or circle your answer(s) to each question, or write your answer in the blank provided. Remember, there may be more than one correct choice for a question. When you complete the exercise, fold over the right side of the page to check your answers. Then turn the page to get more information about each question.

1) Which question(s) can be answered by looking at exposure limits on an MSDS?

- A) Is the material a health hazard?
- B) Is breathing the material hazardous?
- C) Is the material a carcinogen?
- D) How much can be airborne?
- E) Can I see or smell it?

2) Which type of exposure limits are set by OSHA?

- A) TLVs
- B) RELs
- C) PELs
- D) ANSI limits

Answer Additional Information

- 3) A, B, C, D Health effects and first-aid procedures vary with the exposure route. Thus, MSDSs must identify known health effects and recommended first-aid procedures for each exposure route that may be hazardous.

MSDSs must identify both immediate and delayed health effects. Immediate health effects appear right away, whereas delayed effects develop slowly over time. Exposure limits are set for airborne hazards, not for specific exposure routes.

- 4) A MSDSs must specify the specific type of gloves or protective eyewear required. For example, impervious gloves and full-face protection are required for working safely with strong acids. The MSDS cannot simply say that gloves and eye protection are required.

Note: *Point out that MSDSs may not be specific enough — e.g., may specify impervious gloves but not the length or cuff type required for trainee's specific operation.*

Emphasize the importance of using the exact type of PPE specified for the job.

Note: *Direct trainees either to proceed to Application Exercise 6-2 when finished, or to wait for further instructions. If time allows, ask the Optional Questions that begin on page 6-12 of this guide.*

- 3) What must the MSDS tell you for *EACH* exposure route?
- A) Exposure limits
 - B) Immediate health effects
 - C) Delayed health effects
 - D) First-aid procedures
- 4) If required, does the MSDS have to tell you the specific type of protective gloves and eyewear that you need?
- A) Yes
 - B) No

Now go back to page 6-5, fold over the right side of the page, and check your answers. Look on the back of the question page for more information on each question. If you are taking this course as a self-study, continue to the Application Exercise 6-2, "Using MSDS Health Hazard Information," when you have finished. If you are taking this course in a classroom situation, wait for further instructions from your trainer when finished.

TRAINER'S OPTIONAL QUESTIONS: Application Exercise 6-1

O1) Must MSDSs identify carcinogens?

Answer: Yes

The MSDS must identify carcinogens —

- regulated by OSHA;
- listed in the annual report published by the National Toxicology Program (NTP); and
- identified by the International Agency for Research on Cancer (IARC).

O2) Must the MSDS identify medical conditions that can be made worse by exposure to a chemical?

Answer: Yes

MSDSs must identify any medical conditions that may become worse when a person is exposed to the material.

Someone who has a medical condition that is listed on an MSDS should consult a doctor to find out whether it is safe to work with the material.

O3) What information do you need to identify the correct first-aid procedure?

Answer: Chemical identity, exposure route, worker's condition

Correct first-aid procedures depend on the *IDENTITY OF THE CHEMICAL*, the *EXPOSURE ROUTE*, and the *PERSON'S CONDITION*.

For example, ingestion of one chemical may require drinking plenty of water while ingestion of another requires someone to induce vomiting. Inhalation of both these chemicals may require moving conscious victims to fresh air and getting immediate medical attention for unconscious victims.

Using the correct first-aid procedure is vital because taking the wrong action can have serious medical consequences.

STUDENT WORKBOOK: No Reference

- O4)** *Point out that MSDSs cannot leave blank spaces and ask: Does a "Yes" satisfy OSHA's requirement for identifying the need for respiratory PPE?*

Answer: No

If respiratory protection is *NOT* normally required, the MSDS should say so. MSDSs should not contain blank spaces. Often, the abbreviation NA is used to indicate Not Applicable — which means the protection is not required.

If respiratory protection *IS* required, the MSDS must specify the specific type needed — such as an air-purifying respirator that removes organic vapors. The MSDS cannot simply state "Yes" or "Required."

- O5)** Does the MSDS have to specify the specific type of local or general ventilation system required?

Answer: No

The MSDS must identify the category of ventilation required — local exhaust, general, or some special category.

However, there are numerous different types of ventilation systems within each of these basic categories. Often, selection of the appropriate specific type depends more on the operation or work environment than on the chemical. Thus, it would be impractical for MSDSs to specify the specific type of ventilation system required within each category.

STUDENT WORKBOOK: No Reference

TRAINER'S NOTES: Application Exercise 6-2

Ask trainees to turn to page 6-9 of their Student Workbook. Either lead the class through Application Exercise 6-2 as a group activity, or provide time for students to complete the exercise individually or in small groups. The answers and additional information given below appear on pages 6-10 and 6-12 of the Student Workbook.

Do one of the following:

- Refer trainees to the MSDS for Caustic Soda Beads in Appendix A (pages A-6 to A-7) of their workbook and ask each question.*
 - Tailor the activity to your facility by handing out or projecting MSDSs for several commonly used chemical materials in your facility and asking questions similar to questions 1 through 3.*
-

Answer	Additional Information
---------------	-------------------------------

- | | |
|------|---|
| | The MSDS for Caustic Soda Beads is located on pages A-6 to A-7 of Appendix A. |
| 1) B | <p>The Health Hazard Data Section, Section VI, clearly identifies this material as a corrosive. It destroys body tissues upon contact, and it can cause serious burns, permanent blindness, or death upon ingestion. Although the effect of exposure can be only mild irritation, this material is not classified as an irritant. Irritants are capable of causing only minor health effects, not life-threatening or disabling burns.</p> <p>Section VI also tells you that neither the NTP, IARC, nor OSHA considers this material either a carcinogen or potential carcinogen. The MSDS does not identify any effects associated with entry into the bloodstream. This corrosive is a contact hazard, not a target organ chemical, reproductive hazard, or sensitizer.</p> |
| 2) C | <p>The FIRST-AID PROCEDURES given in the Health Hazard Data Section give specific instructions for each exposure route. For ingestion, the MSDS recommends giving large amounts of water — provided that the victim is conscious. This is the correct procedure for ingestion of most corrosives. You should <i>NOT</i> try to make the victim throw up because the corrosive would burn as it came back up.</p> <p>For inhalation, the correct procedure is either to get the victim to fresh air (breathing) or to give artificial respiration (not breathing). Skin or eye contact calls for "flushing" the exposed area with water, which means running water over it for at least 15 minutes.</p> |

APPLICATION EXERCISE 6-2:
Using Health Hazard Data on MSDSs

Directions: Check or circle your answer(s) to each question, or write your answer in the blank provided. Remember, there may be more than one correct choice for a question. When you complete the exercise, fold over the right side of the page to check your answers. Then turn the page to get more information about each question.

Locate the MSDS for Caustic Soda Beads in Appendix A and use this MSDS to answer the following questions.

- 1) What type of health hazard(s) does this material present?
 - A) Irritant
 - B) Corrosive
 - C) Target organ chemical
 - D) Reproductive hazard
 - E) Sensitizer
 - F) Carcinogen

- 2) What should you do if a co-worker accidentally swallows some of this chemical?
 - A) Try to make the person throw up
 - B) Get the victim to fresh air
 - C) Make the person drink a lot of water
 - D) Begin artificial respiration

Answer Additional Information

- 3) B C D Generally required protective equipment is identified in the Control Measures Section. This includes a respirator with a high efficiency filter to remove any corrosive mists or vapors. Rubber gloves, apron and chemical splash-proof goggles are also recommended.

Note: *Direct trainees either to proceed to the Lesson Summary when finished, or to wait for further instructions. If time allows, ask the Optional Questions that begin on page 6-20 of this guide.*

3) What type(s) of special protection might be required to work safely with solutions of this material?

- A) Air-supplied respirator
- B) Air-purifying respirator
- C) Chemical splash-proof goggles
- D) Rubber gloves
- E) Full-body protective clothing

Now go back to page 6-9, fold over the right side of the page, and check your answers. Look on the back of the question page for more information on each question. If you are taking this course as a self-study, proceed to the Lesson Summary when you have finished. If you are taking this course in a classroom situation, wait for further instructions from your trainer when finished.

TRAINER'S OPTIONAL QUESTIONS: Application Exercise 6-2

Do one of the following:

- *Refer trainees to the MSDS for Steel Alloys in Appendix A (pages A-16 to A-17) of their workbook and ask each question.*
 - *Tailor the activity to your facility by handing out or projecting MSDSs for several commonly used chemical materials in your facility and asking questions analogous to questions O1 through O7.*
-

O1) Can steel alloys present a health hazard?

Answer: Yes

Look at the Health Hazard Data in Section VI.

Bulk steel is not a health hazard, but exposure to steel alloy dusts or fumes can cause both immediate (or acute) and delayed (or chronic, long-term) health effects.

O2) Which exposure route or routes are hazardous?

Answer: Breathing/Inhalation, Ingestion

Look at the Health Hazard Data in Section VI of the MSDS. It says that inhaling metal alloy fumes may cause chills and fever. It also says that the material can enter the body through breathing (inhalation).

Ingestion of metallic dusts can also be hazardous because the metals tend to accumulate in the body.

STUDENT WORKBOOK: No Reference

03) BY LAW, what is the exposure limit for iron oxide fumes?

Answer: 10 mg/m³

Look at the exposure limits included in the Hazardous Ingredients Information given in Section II.

OSHA PELs are the only exposure limits set by law. The PEL for iron oxide fumes (a hazardous decomposition product of the iron component) is 10 mg/m³. Compliance with exposure limits recommended by the ACGIH is voluntary.

04) Can exposure to steel alloy fumes cause cancer?

Answer: Yes

The Health Hazard Data Section says that two metals in the steel alloy can cause cancer. Both nickel and chromium are listed as carcinogens by the National Toxicology Program (NTP) and the International Agency for Research on Cancer.

The additional health hazard information contained in the MSDS says that exposure to either nickel or chromium fumes can cause cancer of the nasal passages and lungs.

05) What exposure symptom(s) can develop slowly over time?

Answer: Lung, kidney, and muscle damage

The Health Hazard Data in Section V of the MSDS says that the chill and fever associated with "metal fume fever" disappear within 48 hours following exposure. This is an immediate (or acute) effect.

The additional notes on delayed health effects in the Special Precautions Section say that chromium, manganese, and nickel fumes can cause *LUNG DISEASE*. Exposure to lead fumes can *DAMAGE THE KIDNEYS* and *AFFECT MUSCLE STRENGTH*.

STUDENT WORKBOOK: No Reference

O6) *List choices and ask:* Which medical condition might be made worse by exposure to steel alloy dusts or fumes?

- A) Low blood pressure
- B) Stomach ulcer
- C) Near-sightedness
- D) Asthma

Answer: D; Asthma

The Health Hazard Data Section says that chronic lung disease can be aggravated by exposure to steel alloy fumes or dusts. Asthma may be considered to be a chronic lung disease.

O7) What type of protective equipment may be required for welding or grinding operations?

Answer: Dust/fume respirator, local exhaust ventilation

Look at the information given in Section VIII of the MSDS. It specifies use of a *DUST/FUME RESPIRATOR* and *LOCAL EXHAUST VENTILATION* for particulates to remove airborne hazards in welding and grinding operations.

General exhaust ventilation is not suitable for removing metal dusts or fumes because the particulates are too heavy.

STUDENT WORKBOOK: No Reference

If time permits, review and reinforce the learning objectives by asking the questions suggested below. Draw trainee's attention to the tables in the Summary of the Student Workbook. Point out that the tables summarize how to read and use the sections of the MSDS covering health hazard information.

Note: *Make sure that you actually provide practice using MSDSs.*

Q1) Which sections of the MSDS contain specific information about health hazards?

Answer: Three sections of the MSDS contain specific information about health hazards.

- Hazardous Ingredients Section
- Health Hazard Data Section
- Control Measures Section

Q2) *If time permits, provide practice using the tables on pages 6-13 and 6-14 of the Student Workbook by asking questions such as the following:*

- What information tells you how much of the material can be present in the air you breathe without causing adverse health effects in the average person exposed to that level over a working lifetime?

Answer: Exposure limits

- What does the MSDS tell you about exposure hazards?

Answer: How you can be exposed and what health effects may result

LESSON 6 SUMMARY

Three sections of the MSDS contain specific information about health hazards.

- Hazardous Ingredients Section
- Health Hazard Data Section
- Control Measures Section

The following table summarizes the information you will find in the **Hazardous Ingredients Section**.

Data	Question Answered	Explanation
EXPOSURE LIMITS	Is it a health hazard? Is breathing it harmful? How much can be in the air, without causing adverse health effects in exposed individuals?	YES if a limit is given. YES if a limit is given. Limit gives parts of contaminant per million parts of contaminated air (ppm) or milligrams (mg) per cubic meter; PELs (Permissible Exposure Limits) are mandatory.

The following table summarizes the information you will find in the **Health Hazard Data Section**.

Data	Question Answered	Explanation
EXPOSURE HAZARDS	How can I be exposed? What can it do to me?	If any are known, MSDS must give both immediate and delayed health effects for each exposure route.
FIRST-AID PROCEDURES	What first-aid procedure should I use?	Follow the recommended procedure given for the person's exposure route and current condition.

- What questions does the MSDS answer about required controls for inhalation hazards?

Answer: Need for ventilation and/or respiratory PPE and specific type(s) required

The following table summarizes the information you will find in the **Control Measures Section**.

Data	Question Answered	Explanation
RESPIRATORY PROTECTION	Do I need respiratory PPE? What type do I need?	YES if any type listed. Air-supplied or specific type of air-purifying should be given.
VENTILATION	Is ventilation required? Is local exhaust needed? Is general needed? Is a special type needed?	YES if any identified. YES if section identifies. YES if section identifies. YES if section identifies.
PROTECTIVE GLOVES	Do I need gloves? What type do I need?	YES if any identified. MSDS must state type.
EYE PROTECTION	What type of eye protection do I need?	MSDS must state specific type needed.
OTHER PROTECTIVE EQUIPMENT	What other protective equipment is required?	Any listed.

**LESSON 7: USING LABELS AND THE HAZARDOUS CHEMICAL
INVENTORY**

TRAINER'S NOTES: Introduction and Learning Objectives

Ask trainees to look at the Introduction and Learning Objectives of page 7-1 of their Student Workbook and emphasize the following:

- In addition to MSDSs, the Hazard Communication Standard requires hazard warning labels, a Hazardous Chemical Inventory, and a written Hazard Communication Program.
- In this lesson, you'll see —
 - what types of containers must be labeled;
 - what information warning labels and the Hazardous Chemical Inventory contain;
 - how you can use these documents to help protect your health and safety.

LESSON 7: USING LABELS AND THE HAZARDOUS CHEMICAL INVENTORY

INTRODUCTION

The Hazard Communication Standard requires the use of warning labels. It also requires a Hazardous Chemical Inventory that names all hazardous chemical materials in your workplace. In this lesson, you will see —

- what information these documents contain; and
- how to use the labels and Inventories available in your workplace.

LEARNING OBJECTIVES

When you have completed this lesson, you should be able to do the following:

- ___ Identify information that must be included on all warning labels.
- ___ Identify containers that do and do not require warning labels.
- ___ Use warning labels to identify information about chemical hazards and to find the right MSDSs for additional information.
- ___ Describe the Hazardous Chemical Inventory and its uses.
- ___ List four types of chemicals excluded from OSHA's labeling requirement.

TRAINER'S NOTES: Learning Resources

Videotape Segments 7, located on Tape 2

Note: *On VHS or BETA videotapes, all seven segments are on one videotape.*

TRAINER'S NOTES: Directions for Proceeding

Direct trainees to disregard page 7-2 and to proceed to page 7-3 in the Student Workbook.

LEARNING RESOURCES

- Videotape Segment 7: Labels and The Hazardous Chemical Inventory
- Workbook Application Exercise 7-1: Knowing About Labels and The Hazardous Chemical Inventory
- Workbook Application Exercise 7-2: Using Labels and The Hazardous Chemical Inventory
- Lesson Summary

DIRECTIONS FOR PROCEEDING

Complete the following steps in order. You might want to check off each step as you complete it.

- ___ 1) Read the workbook introduction to Videotape Segment 7.
- ___ 2) Watch Videotape Segment 7.
- ___ 3) Complete Application Exercise 7-1 in this workbook.
- ___ 4) Complete Application Exercise 7-2 in this workbook.
- ___ 5) Read the Lesson Summary.

TRAINER'S NOTES: Introduction to Videotape Segment 7

Note: *Ask trainees to look at the videotape introduction on page 7-3 of the Student Workbook.*

■ As we watch this videotape, you should learn —

- how the written documents, the MSDS, the Hazardous Chemical Inventory, the Label, and the Written Hazard Communication Program work together; and
- how you can use warning labels and the Inventory to help control chemical hazards in your facility.

INTRODUCTION TO VIDEOTAPE SEGMENT 7: Labels and The Hazardous Chemical Inventory

OSHA requires four written documents to help protect you from chemical hazards in the workplace.

- Warning labels
- Hazardous Chemical Inventory
- MSDSs
- Local Written Hazard Communication Program

As you watch this videotape segment, notice how these documents work together. Pay close attention to the information labels contain, and how you can use labels to help protect yourself from chemical hazards. Also watch for ways you can use the Hazardous Chemical Inventory in your workplace.

Now, watch Videotape Segment 7.

TRAINER'S NOTES: Application Exercise 7-1

Ask trainees to turn to page 7-5 of their Student Workbook. Either lead the class through Application Exercise 7-1 as a group activity, or provide time for students to complete the exercise individually or in small groups. The answers and additional information given below appear on pages 7-6 and 7-8 of the Student Workbook.

Answer	Additional Information
---------------	-------------------------------

- | | |
|---------|--|
| 1) A, D | The Hazard Communication Standard says that every warning label MUST include: |
|---------|--|

- Name of the chemical material
- All appropriate hazard warnings

Other information, such as a manufacturer's, importer's or other responsible party's name or address, may also be included, and usually is. But this information does not have to be on the label unless the container leaves the workplace.

- | | |
|------|---|
| 2) B | The Hazard Communication Standard requires every employer to inform employees about the hazards of any chemicals contained in unlabeled pipes in their work area. The method used to do this must be described in the written Hazard Communication Program. |
|------|---|

Pipes do not have to be labeled because the Standard does not consider pipes to be containers. Containers that do require labels include bags, barrels, bottles, boxes, cans, cylinders, drums, reaction vessels, and storage tanks, or the like, that contain hazardous chemicals.

The Hazardous Chemical Inventory is just that — an inventory or list of hazardous chemicals known to be present in the workplace. It does not contain specific hazard information.

APPLICATION EXERCISE 7-1:
Knowing About Labels and The Hazardous Chemical Inventory

Directions: Check or circle your answer(s) to each question, or write your answer in the blank provided. Remember, there may be more than one correct choice for a question. When you complete the exercise, fold over the right side of the page to check your answers. Then turn the page to get more information about each question.

- 1) What information **MUST** be included on **EVERY** warning label?
 - A) Name of the chemical material
 - B) Chemical formula
 - C) Name and address of supplier or manufacturer
 - D) All appropriate hazard warnings

- 2) How can you find out about the hazards of chemicals traveling through your work area inside pipes?
 - A) Read the warning label — all pipes carrying chemicals must be labeled.
 - B) I must be informed by my employer — the OSHA Standard requires this.
 - C) Find out the name of the chemical and look up its hazards on the Hazardous Chemical Inventory.
 - D) I have no right to know about the hazards of chemicals inside pipes because pipes are not considered containers.

STUDENT WORKBOOK PAGE: 7-5

- | Answer | Additional Information |
|---------------|--|
| 3) A | <p>This safety can must be labeled because more than one worker uses it. Only transfer containers that meet <i>BOTH</i> of the following requirements are exempt from the labeling requirement.</p> <ul style="list-style-type: none">• Container used by only <i>ONE</i> worker; <i>AND</i>• Container filled <i>AND</i> emptied during the same shift. |
| 4) B | <p>The <i>SAME</i> name must be used on the label, the Hazardous Chemical Inventory, and the MSDS. OSHA requires use of the same name to make it easier to use the label or Inventory to find the right MSDS.</p> |
| 5) A, B, C | <p>When a chemical IS included on the Hazardous Chemical Inventory, all of the following are true.</p> <ul style="list-style-type: none">• The chemical is found in your workplace.• The chemical is hazardous.• Containers of the chemical must be labeled.• An MSDS for the chemical must be readily accessible to you during your workshift, when you are in your work area. |

Note: *Direct trainees either to proceed to Application Exercise 7-2 when finished, or to wait for further instructions. If time allows, ask the Optional Questions that begin on page 7-12 of this guide.*

- 3) Scott fills a one-gallon safety can with solvent. A few minutes later, Ellen picks up the same safety can and empties it into a parts washer. Does this safety can require a label?
- A) Yes
 - B) No
- 4) Can the name used on a label differ from the name used on the Hazardous Chemical Inventory?
- A) Yes
 - B) No
- 5) Suppose paint thinner IS on the Hazardous Chemical Inventory for your workplace. Which of the following is/are true?
- A) Paint thinner is a chemical hazard.
 - B) Containers of paint thinner must be labeled.
 - C) An MSDS for paint thinner must be available.

Now go back to page 7-5, fold over the right side of the page, and check your answers. Look on the back of the question page for more information on each question. If you are taking this course as a self-study, continue to the Application Exercise 7-2, "Using Labels and The Hazardous Chemical Inventory," when you have finished. If you are taking this course in a classroom situation, wait for further instructions from your trainer when finished.

TRAINER'S OPTIONAL QUESTIONS: Application Exercise 7-1

O1) *List choices on chalkboard and ask:* Which containers can be labeled by using a wall placard?

- A) Stationary vats
- B) Transfer vessels
- C) Large solvent drums
- D) Any type of chemical container

Answer: A; Stationary Vats

Labels must be attached to most chemical containers, but not to stationary ones like vats or storage bins. Wall placards or bin labels can be used provided that —

- the stationary container(s) to which it applies are clearly identified.
- the placard(s) or bin labels convey the identity of the chemicals in the container and the appropriate hazard warnings for those chemicals.

Wall placards or bin labels must contain the same information as any other type of hazard warning label.

O2) *List choices on chalkboard and ask:* What is the fastest way to find out whether a hazardous chemical material called acetone is used in our facility?

- A) Find a container of acetone and see if it's labeled.
- B) See if acetone is on the Hazardous Chemical Inventory.
- C) Request a copy of the MSDS for acetone.

Answer: B

Looking for the name on the Hazardous Chemical Inventory is usually the fastest way to find out whether a hazardous chemical material is used in your workplace. If acetone *IS* used, it must be on the Inventory because it is flammable, and is a health hazard.

STUDENT WORKBOOK PAGE: No Reference

O3) What must the Hazardous Chemical Inventory include?

Answer: Names of all hazardous chemical materials used in the workplace

The Hazardous Chemical Inventory must include ALL hazardous chemical materials used in the workplace. This includes both physical hazards and health hazards.

O4) *List choices on chalkboard and ask:* if a chemical is NOT included on the Hazardous Chemical Inventory in your workplace, which of the following statements **MUST** be true?

- A) Chemical is not hazardous.
- B) Chemical is not used in the workplace.
- C) Either A or B.

Answer: C

If a chemical is NOT on the Inventory in your workplace, it means **EITHER** that it's not hazardous **OR** that it's not found in your workplace.

Just because a chemical is not included on the Hazardous Chemical Inventory does not mean that it's not hazardous. For example, methyl chloromethyl ether is one of the carcinogens regulated by OSHA. If this chemical does not appear on the Inventory, it means only that methyl chloromethyl ether is not used in the facility.

STUDENT WORKBOOK: No Reference

TRAINER'S NOTES: Application Exercise 7-2

Ask trainees to turn to page 7-9 of their Student Workbook. Either lead the class through Application Exercise 7-1 as a group activity, or provide time for students to complete the exercise individually or in small groups. The answers and additional information given below appear on pages 7-10 and 7-12 of the Student Workbook.

Do one of the following:

- *Refer trainees to the appropriate appendix of their workbook and ask each question as is.*
- *Tailor the activity to your facility.*
 - *Hand out copies of a portion of the Hazardous Chemical Inventory for your facility and write several questions similar to questions 1 through 3 on page 7-19 on the chalkboard.*
 - *Hand out or project copies of the hazard warning labels for several commonly used chemical materials in your facility and ask questions similar to questions 4 and 5 on page 7-21 (i.e., substitute the name of the chemical material on your warning labels for 1,1,1-trichloroethane and methanol).*

In either case, be sure to remind trainees about —

- *the availability of the Hazardous Chemical Inventory or list of hazardous chemicals in your facility;*
 - *locations where warning placards or bin labels are used; and*
 - *hazards associated with any unlabeled pipes that carry chemical materials through your facility.*
-

If using the sample Hazardous Chemical Inventory in Appendix C of this guide, make a handout, or ask trainees to locate the sample Hazardous Chemical Inventory in Appendix C of their workbook. Use this sample Inventory to answer questions 1 to 3.

STUDENT WORKBOOK: No Reference

Answer	Additional Information
1) B D E	<p>Stop-Rust, Black; Tight Seal; and Clear Spray are included in the sample Hazardous Chemical Inventory in Appendix C.</p> <p><i>Make sure the name you are looking for matches the name on the Inventory exactly. Epoxy Paint - Blue 207 is on this Inventory, but Epoxy Paint - Blue Prime 107 is not. Similarly, AC Dark Blue and AC Light Blue Gloss are on the Inventory, but AC Dark Blue Gloss is not.</i></p>
2) B	<p>Only Texas Oil Co. Anti-Freeze is listed for the 239th Street Maintenance Shop. When the Hazardous Chemical Inventory covers several different facilities, individual inventories may be available for each facility. Similarly, specific Inventories may be put together for individual work areas.</p>
3) B	<p>Blue spray paint is used in five of the facilities covered by this Hazardous Chemical Inventory, but the Pitkin Shop is not listed as a "USE POINT."</p>

APPLICATION EXERCISE 7-2:
Using Labels and The Hazardous Chemical Inventory

Directions: Check or circle your answer(s) to each question, or write your answer in the blank provided. Remember, there may be more than one correct choice for a question. When you complete the exercise, fold over the right side of the page to check your answers. Then turn the page to get more information about each question.

Appendix C contains a sample Hazardous Chemical Inventory. Use it to answer the following questions.

- 1) Which of the following chemical hazards are used in the workplace to which this Hazardous Chemical Inventory applies?
 - A) Epoxy Paint - Blue Prime 107
 - B) Stop Rust, Black
 - C) AC Dark Blue Gloss
 - D) Tight Seal
 - E) Clear Spray

- 2) Which brand of Anti-Freeze is used in the 239th Street Maintenance Shop?
 - A) Pioneer Oil
 - B) Texas Oil Co.
 - C) Titan Research

- 3) Is Blue Spray Paint used in the Pitkin Shop?
 - A) Yes
 - B) No

Refer trainees to the DoD warning label for 1,1,1-trichloroethane in Appendix B (page B-3) of their Student Workbook and ask question 4.

Answer	Additional Information
---------------	-------------------------------

The warning label for 1,1,1 trichloroethane is located on page B-3 of Appendix B.

- | | |
|------|---|
| 4) B | The label tells you that 1,1,1 trichloroethane <i>IS NOT</i> a fire hazard. |
|------|---|

Refer trainees to the DoD warning label for methanol in Appendix B (page B-2) of their Student Workbook and ask question 5.

The warning label for methanol is located on page B-2 of Appendix B.

- | | |
|----------|---|
| 5) A B C | The label for methanol warns you to protect your eyes, skin, and respiratory tract. You need to protect yourself against eye contact by wearing eye protection. The proper gloves can protect against skin contact, and a respirator or ventilation system protects against breathing hazardous airborne forms of the chemical. |
|----------|---|

Note: *Direct trainees proceed to the Lesson Summary when finished or to wait for further instructions. If time allows, ask the Optional Questions that begin on page 7-22 of this guide.*

APPLICATION EXERCISE 7-2

Continued

Locate the DoD Hazard Warning Label for 1,1,1-trichloroethane in Appendix B and use it to answer the following question.

4) Can 1,1,1 trichloroethane cause a fire?

A) Yes

B) No

Locate the DoD Hazard Warning Label for methanol in Appendix B and use it to answer the following question.

5) What kind(s) of protection do you need when working with methanol?

A) Eyewear

B) Gloves

C) Respirator or ventilation system

Now go back to page 7-9, fold over the right side of the page, and check your answers. Look on the back of the question page for more information on each question. If you are taking this course as a self-study, proceed to the Lesson Summary when you have finished. If you are taking this course in a classroom situation, wait for further instructions from your trainer when finished.

TRAINER'S OPTIONAL QUESTIONS: Application Exercise 7-2

Refer trainees to the warning label for 1,1,1-trichloroethane (page B-3 of Appendix B in their student workbook). Use it to answer questions O1 through O3 about this chemical material.

O1) Is 1,1,1-trichloroethane a physical hazard, a health hazard, or both?

Answer: Both

1,1,1-Trichloroethane is a health hazard because exposure can cause adverse health effects. The label indicates moderate health hazards and immediate health effects of dizziness, rapid heartbeat, and headache. Liver damage is noted as a delayed effect. It is a physical hazard because it is chemically reactive. It produces highly toxic gases when exposed to hot metal surfaces or strong ultraviolet light.

O2) What parts of your body require protection when working with 1,1,1-trichloroethane?

Answer: Skin, eyes, respiratory tract

The written **HAZARD WARNING** on the label warns you to protect your skin, eyes and respiratory system. The contact hazard is marked as moderate, and the label states contact will irritate the eyes and skin.

O3) *List choices and ask:* What symptoms might alert you to a leak in a container of 1,1,1-trichloroethane?

A) Eye irritation B) Nausea C) Dizziness D) Lung damage

Answer: A, C

Immediate effects (those felt right away) can alert workers to an exposure hazard that should be controlled. Breathing vapors that form when 1,1,1-trichloroethane leaks can cause the immediate health effects of eye irritation, dizziness, rapid heartbeat and headaches.

Recognizing and reporting these symptoms helps to get the hazard controlled. By controlling the hazard, workers can help prevent the more serious, delayed health effects that can develop slowly if someone is continuously or repeatedly exposed to this or another hazardous material.

STUDENT WORKBOOK: No Reference

TRAINER'S OPTIONAL QUESTIONS: Application Exercise 7-2 Continued

Refer trainees to the warning label for methanol in Appendix B (page B-2) of their student workbook. Use this label to answer questions O4 and O5 about this chemical material.

- O4)** What might happen over time if you are repeatedly exposed to methanol vapors?

Answer: Damage to central nervous system, eyesight, liver

Delayed health effects develop slowly over time rather than during or immediately following exposure. Often, but not always, such delayed effects are associated with repeated exposures.

This label warns you that exposure to methanol can lead to **CENTRAL NERVOUS SYSTEM DAMAGE** or **BLINDNESS**. Repeated exposure can also lead to **LIVER DAMAGE**. The dizziness and irritation go away when exposure stops.

- O5)** What materials must be kept away from methanol?

Answer: Strong acids, oxidizers

Like many chemical materials, methanol reacts violently with certain other chemicals. This label warns you to avoid contact with **STRONG ACIDS**, as well as **OXIDIZERS**. Heeding this warning prevents a hazardous or emergency situation that could seriously injure you or someone else.

STUDENT WORKBOOK: No Reference

TRAINER'S NOTES: Lesson 7 Review

Note: *Briefly mention or refer students to the following types of chemicals, which are exempt from the labeling requirement of the Hazard Communication Standard. Explain that these chemicals are exempt because they are already subject to labeling under other Federal Regulations.*

- **PESTICIDES** covered by the Federal Insecticide, Fungicide, and Rodenticide Act (MSDSs must be available for pesticides).
 - **FOOD, FOOD ADDITIVES, COLOR ADDITIVES, DRUGS, COSMETICS, AND INGREDIENTS IN THESE PRODUCTS** covered by the Federal Food, Drug, and Cosmetic Act.
 - **DISTILLED SPIRITS, WINE, OR MALT BEVERAGES** not intended for industrial use covered by the Federal Alcohol Administration Act.
 - **CONSUMER PRODUCTS AND HAZARDOUS SUBSTANCES** covered by the Consumer Product Safety and Federal Hazardous Substances Acts. MSDSs must be available where the use of these products results in worker exposures significantly greater than those of consumers.
-

If time permits, review and reinforce the learning objectives by asking the following open-ended questions answered in the summary. Refer trainees to the Summary in the student workbook for future reference.

Note: *Make sure that you actually provide practice using an inventory and warning labels.*

Q1) What information must all warning labels contain?

Answer: Chemical name/identity, all appropriate hazard warnings

The Hazard Communication Standard requires the use of hazard warning labels that include —

- the name and identity of the chemical that matches the name and identity on the MSDS and Hazardous Chemical Inventory; **AND**
- **ALL** appropriate hazard warnings, including target organ health effects.

Labels on containers that leave the workplace must also contain the name and address of the responsible party. The warning label is often the first source of information about chemical hazards. The name and identity on the label can be used to locate the MSDS, where additional information can be found.

LESSON 7 SUMMARY

The Hazard Communication Standard requires the use of hazard warning labels that include —

- The name and identity of the chemical that matches the name and identity on the MSDS and Hazardous Chemical Inventory; *AND*
- *ALL* appropriate hazard warnings.

Labels on containers that leave the workplace must also contain the name and address of the responsible party. The warning label is often your first source of information about chemical hazards. The name and identity on the label can be used to find the right MSDS, where you will find additional information.

Warning labels must be affixed to bags, barrels, bottles, boxes, cans, cylinders, drums, reaction vessels, storage tanks, and other chemical containers. Placards or bin labels can be used for stationary containers as long as the placard clearly identifies the containers to which it applies, and provides the same information required for any other type of hazard warning label.

Pipes carrying chemicals do not have to be labeled, but you must be informed about the hazards of any chemicals carried through your work area in unlabeled pipes. A transfer container does not have to be labeled provided that only one person handles the container and the container is filled and emptied in the same shift.

The following types of chemicals are exempt from the OSHA labeling requirement because labeling is required by other federal laws.

- Pesticides covered by the Federal Insecticide, Fungicide, and Rodenticide Act (MSDSs must be available for pesticides).
- Food, food additives, color additives, drugs, cosmetics, and ingredients in these products covered by the Federal Food, Drug, and Cosmetic Act.
- Distilled spirits, wine, or malt beverages not intended for industrial use covered by the Federal Alcohol Administration Act. MSDSs must be available if the use of these products results in worker exposures significantly greater than those of consumers.
- Consumer products and hazardous substances covered by the Consumer Product Safety and Federal Hazardous Substances Acts. MSDSs must be available, if the use of these products results in worker exposures significantly greater than those of consumers.

Q2) What types of containers must be labeled?

Answer:

Warning labels must be affixed to bags, barrels, bottles, boxes, cans, cylinders, drums, reaction vessels, storage tanks, and other chemical containers.

Q3) What are the two types of containers that do not require individual labels? (Define labeling requirements for stationary and transfer containers.)

Answer: Stationary and transfer containers

Placards or bin labels can be used for stationary containers as long as the placard clearly identifies the containers to which it applies and provides the same information required for any other type of hazard warning label. A transfer container does not have to be labeled provided that only one person handles the container, and that the container is filled and emptied in the same shift.

Q4) Do pipes carrying chemicals have to be labeled?

Answer: No

Pipes carrying chemicals do not have to be labeled, but workers must be informed about the hazards of, and control measures for any chemicals carried through their work area in unlabeled pipes. Although these pipes do not require labeling, MSDSs must still be made available to workers for the chemicals in those pipes.

Q5) What is the Hazardous Chemical Inventory and how can you use it?

Answer:

The *HAZARDOUS CHEMICAL INVENTORY* must name all hazardous chemical materials currently found in your workplace. Containers of materials on the Hazardous Chemical Inventory must be labeled, tagged, or placarded and MSDSs must be available for every material on the Inventory.

The Inventory can be used to find out whether a hazardous chemical material is found in the workplace. It can also be used to see if a material found in the workplace is considered hazardous.

The Hazardous Chemical Inventory must name all hazardous chemical materials currently found in your workplace. Containers of materials on the Hazardous Chemical Inventory must be labeled, tagged, or placarded, and MSDSs must be available for every material on the Inventory. You can use the Inventory to find out whether a hazardous chemical material is used in your workplace. You can also use the Inventory to see if a material you work with is considered hazardous. If it is hazardous, it must be on the Hazardous Chemical Inventory.

Congratulations! You have now completed this course. It's time to put what you've learned to work. But remember to keep this workbook handy — it's your personal reference on working safely with chemical materials.

If you desire further information about the Hazard Communication Standard or about the information you've been studying in this course, contact:

Name

Title

at

Telephone

STUDENT WORKBOOK PAGE: 7-14ST

APPENDIX A
MATERIAL SAFETY DATA SHEETS (MSDSs)

Material Safety Data Sheet

May be used to comply with
OSHA's Hazard Communication Standard,
29 CFR 1910.1200. Standard must be
consulted for specific requirements.

U.S. Department of Labor

Occupational Safety and Health Administration
(Non-Mandatory Form)
Form Approved
OMB No. 1218-0072



IDENTITY (As Used on Label and List)

Crystal Clear

Note: Blank spaces are not permitted. If any item is not applicable, or no
information is available, the space must be marked to indicate that.

Section I

Manufacturer's Name

AAA Chemicals

Emergency Telephone Number

215-555-2456

Address (Number, Street, City, State, and ZIP Code)

100 A Street

Telephone Number for Information

215-555-2400

Anytown, NJ 99999

Date Prepared

6/12/85

Signature of Preparer (optional)

Section II — Hazardous Ingredients/Identity Information

Hazardous Components (Specific Chemical Identity; Common Name(s))	OSHA PEL	ACGIH TLV	Other Limits Recommended	% (optional)
Toluene	200 ppm	100 ppm		30
Methylene Chloride	500 ppm	100 ppm		25
Hexane	500 ppm	50 ppm		19
Propane	1000 ppm	N/A		10
Aromatic Naphtha (Stoddard Solvent)	500 ppm	100 ppm		2.0

Note: Propane functions as an aerosol propellant

Section III — Physical/Chemical Characteristics

Boiling Point	120°F	Specific Gravity (H ₂ O = 1)	0.96
Vapor Pressure (mm Hg.)	N/A	Melting Point	N/A
Vapor Density (AIR = 1)	> 1	Evaporation Rate (Butyl Acetate = 1)	> 1

Solubility in Water

Insoluble

Appearance and Odor

Clear liquid with sweet, aromatic odor.

Section IV — Fire and Explosion Hazard Data

Flash Point (Method Used)	Flammable Limits	LEL	UEL
< 20°F (For propellant)	N/A		

Extinguishing Media

Carbon Dioxide, Foam, Dry chemical

Special Fire Fighting Procedures

The contents are under pressure, when exposed to high temperature they will explode.

In case of fire, keep exposed containers cool.

Unusual Fire and Explosion Hazards

Contents are classified as "Extremely Flammable". They can be ignited readily.

NOTE: Fire Data is given for Propane, the most fire hazardous ingredient.

CRYSTAL CLEAR

Section V — Reactivity Data

Stability	Unstable		Conditions to Avoid Elevated (120°F) Temperature
	Stable	X	
Incompatibility (Materials to Avoid) Keep away from all corrosives and active metal (Aluminum, Magnesium, Strong Oxidizers).			
Hazardous Decomposition or Byproducts Combustion Products: Carbon Monoxide; Carbon Dioxide, Phosgene; Hydrogen Chloride.			
Hazardous Polymerization	May Occur		Conditions to Avoid N/A
	Will Not Occur	X	

Section VI — Health Hazard Data

Route(s) of Entry:	Inhalation? YES	Skin? YES	Ingestion? NO
Health Hazards (Acute and Chronic) Central Nervous System Depressant - Symptoms include: dizziness, disorientation, confusion. CHRONIC: Liver & kidney damage will result from long term over-exposure. Symptoms of this effect will not be seen until years of exposure have existed.			
Carcinogenicity:	NTP? YES	IARC Monographs? NO	OSHA Regulated? NO

Signs and Symptoms of Exposure

Worker may appear drunk or confused; headache; nausea; skin-dry and irritated.

Eyes - burning and irritation.

Medical Conditions

Generally Aggravated by Exposure Liver, kidney, conditions and ethanol dependency, respiratory tract conditions.

Emergency and First Aid Procedures

Remove the victim to fresh air if you can without harm to yourself. Begin CPR if breathing has stopped. For skin contact, wash with warm water. For eye contact, flush with water for at least 15 minutes.

Section VII — Precautions for Safe Handling and Use

Steps to Be Taken in Case Material is Released or Spilled

Remove source of ignition. Soak up with absorbent material, and place in closed container. Ventilate area and place in closed container.

Waste Disposal Method

Dispose of as hazardous wastes in accordance with state and federal regulations.

Precautions to Be Taken in Handling and Storing

Do not store above 120°F. Excessive heat will cause containers to burst suddenly and violently. Combustion products are highly toxic.

Other Precautions

Vapors tend to collect in low areas.

Section VIII — Control Measures

Respiratory Protection (Specify Type)

Use self-contained breathing apparatus if vapor conc. above TLVs.

Ventilation	Local Exhaust	Not normally required when vapors conc. less than TLVs.	Special	N/A
	Mechanical (General)	Will often be adequate	Other	N/A

Protective Gloves

Neoprene or butyl rubber

Eye Protection

goggles

Other Protective Clothing or Equipment

Not normally required for aerosol usage.

Work/Hygienic Practices

N/A

May be used to comply with OSHA's Hazard Communication Standard, 29 CFR 1910.1200. Standard must be consulted for specific requirements.

Occupational Safety and Health Administration
(Non-Mandatory Form)
Form Approved
OMB No. 1218-0072



Note: Blank spaces are not permitted. If any item is not applicable, or no information is available, the space must be marked to indicate that

Manufacturer's Name Some Chemical Company	Emergency Telephone Number 318-555-5214
Address (Number, Street, City, State, and ZIP Code) P.O. Box 3758	Telephone Number for Information 318-555-5000
Anytown, OK 74000	Date Prepared 2/26/86
	Signature of Preparer (optional)

[illegible]

Boiling Point (327°C)	620°F	Specific Gravity (H ₂ O = 1)	0.87
Vapor Pressure (mm Hg.)	2.7	Melting Point	N/A
Vapor Density (AIR = 1)	N/A	Evaporation Rate (Butyl Acetate = 1)	N/A
Solubility in Water Negligible			
Appearance and Odor Red oily liquid, slight oily odor			

Flash Point (Method Used)	Flammable Limits	LEL	UEL
202°C (395°F) (COC)		N/A	N/A
Extinguishing Media Carbon Dioxide, dry chemical, foam or water fog. Do not use direct stream of water - product will float and can be reignited on surface of water.			
Special Fire Fighting Procedures Do not enter confined fire space without full Bunker gear, including a positive pressure NIOSH - approved self-contained breathing apparatus.			

Unusual Fire and Explosion Hazards
Water used to extinguish may cause frothing.
Burning liquid will float on water.

Section V — Reactivity Data

Stability	Unstable		Conditions to Avoid None
	Stable	X	Heat, open flames, oxidizing materials

Incompatibility (Materials to Avoid)

Strong oxidizer

Hazardous Decomposition or Byproducts Combustion may result in a complex mixture of air borne solids, liquids and gases. Carbon monoxide and other unidentified organic compounds.

Hazardous Polymerization	May Occur		Conditions to Avoid None
	Will Not Occur	X	

Section VI — Health Hazard Data

Route(s) of Entry:	Inhalation? YES	Skin? NO	Ingestion? YES
Health Hazards (Acute and Chronic) Vapors and mists may cause drowsiness, dizziness, headache, nausea, and respiratory tract irritation. Mist in massive exposure may cause pneumonitis. Ingestion may cause stomach irritation and diarrhea. CHRONIC: Repeated contact with skin may cause drying, cracking, and dermatitis.			

Carcinogenicity:	NTP? NO	IARC Monographs? NO	OSHA Regulated? NO
------------------	------------	------------------------	-----------------------

Signs and Symptoms of Exposure

Drowsiness, headache, nausea, respiratory tract irritation, skin irritation.

Medical Conditions

Generally Aggravated by Exposure Personnel with pre-existing skin or respiratory disorders should avoid contact with this product.

Emergency and First Aid Procedures Remove overcome victim to fresh air and provide oxygen if breathing is difficult. Begin artificial respiration if not breathing. Flush eyes and skin with water for 15 minutes or more. Do not induce vomiting. Get medical attention.

Section VII — Precautions for Safe Handling and Use

Steps to Be Taken in Case Material is Released or Spilled

Dike spill, soak up on absorbent material and dispose of properly. Flush area with water to remove trace residues. Remove large spill with vacuum trucks or pump to storage salvage vessels.

Waste Disposal Method

Dispose of in accordance with EPA and state and local rules.

Precautions to Be Taken in Handling and Storing

Keep away from extreme heat and open flame.

Other Precautions

May burn although not readily ignitable.

Section VIII — Control Measures

Respiratory Protection (Specify Type)

Not normally needed.

Ventilation	Local Exhaust Not normally needed.	Special N/A
	Mechanical (General)	Other

Protective Gloves Chemical resistant gloves to minimize skin contact. Oil proof for prolonged use, NITRILE. Eye Protection Safety goggles.

Other Protective Clothing or Equipment Protective clothing as required to minimize skin contact. Skin misting be anticipated, use MIST respirator or organic vapor.

Work/Hygiene Practices Minimize skin contact. Wash hands with plenty of soap and water after use. Remove oil-soaked clothing and launder before re-use. Properly dispose of contaminated leather articles, including shoes, that cannot be decontaminated.

CAUSTIC SODA BEADS

Section V — Reactivity Data

Stability	Unstable		Conditions to Avoid
	Stable	X	
Incompatibility (Materials to Avoid) Water, acids, flammable materials, chlorinated hydrocarbon, aluminum, tin, zinc, nitro compounds.			
Hazardous Decomposition or Byproducts None			
Hazardous Polymerization	May Occur		Conditions to Avoid None
	Will Not Occur	X	

Section VI — Health Hazard Data

Route(s) of Entry:	Inhalation? YES	Skin? YES	Ingestion? YES
Health Hazards (Acute and Chronic) ACUTE: Mild irritation to major destructive burns. Destructive to all human tissue it contacts. Eye contact can cause blindness. Ingestion can burn mouth, throat, and stomach and may be fatal. Inhalation of mist may be corrosive to upper respiratory tract.			
Carcinogenicity:	NTP? NO	IARC Monographs? NO	OSHA Regulated? NO

Signs and Symptoms of Exposure

Burning: Inhalation of dust or mist vary from minor irritation to severe burning of upper respiratory tract.

Medical Conditions

Generally Aggravated by Exposure Impaired pulmonary function or other respiratory tract disorder.

Chronic skin or eye disorders.

Emergency and First Aid Procedures

Wash immediately with water. For inhalation, get to fresh air.

For ingestion, give large amounts of water. Do not induce vomiting.

Section VII — Precautions for Safe Handling and Use

Steps to Be Taken in Case Material is Released or Spilled

Wear protective equipment to prevent skin and eye contact. Promptly shovel into suitable container. Avoid dust generation.

Waste Disposal Method

Follow local, state and federal regulations. Dilute well with water and carefully neutralize with acid.

Precautions to Be Taken in Handling and Storing

Store away from incompatible materials noted above. Store in well-sealed containers in a dry location, avoid dust generation. Sodium hydroxide will attack some forms of plastics, rubber and coatings.

Other Precautions

When working with solutions, full body protection may be required.

Section VIII — Control Measures

Respiratory Protection (Specify Type)

Air purifying with High Efficiency Filter.

Ventilation	Local Exhaust	N/A	Special	N/A
	Mechanical (General)	N/A	Other	N/A

Protective Gloves

Rubber *(See precautions section)

Eye Protection

Dust and chemical splash-proof safety goggles

Other Protective Clothing or Equipment

Rubber apron, rubber boots (see precautions section)

Work/Hygiene Practices

Eye wash and safety showers must be immediately available. Eating and smoking should not be permitted in areas where sodium hydroxide is stored.

*See "Guide for the Selection of Chemical Protective Clothing", 3rd Edition, Vol. II

A. D. Little (for EPA and U. S. Coast Guard)

MATERIAL SAFETY DATA SHEET

IDENTITY

Methanol/Wood Alcohol

SECTION I

Manufacturer's Name
A Chemical Company

Emergency Telephone Number
215-555-6500

Address
1500 Beacon Street

Telephone Number for Information
215-555-1207

Some City, NJ 99999

Date Prepared
11/09/85

SECTION II - Hazardous Ingredients/Identity Information

Methanol (Wood alcohol; wood naphtha) 200 ppm 200 ppm 100%

SECTION III - Physical/Chemical Characteristics

Boiling Point: 64.51°C Specific Gravity (H₂O = 1) 0.7924

Vapor Pressure:
@ 20°C 97.30 Melting Point -97.8°C

Vapor Density: 1.1 Evaporation Rate 5.9

Solubility in Water: Complete

Appearance and Odor: Clear, colorless, liquid with an alcohol odor.

SECTION IV - Fire and Explosion Hazard Data:

Flash Point (Method Used)	Flammable Limits	LEL	UEL
11°C (52°F) (Closed cup)		6.0%	36%

Extinguishing Media:

Dry chemical, foam, carbon dioxide, water fog.

Special Fire Fighting Procedures:

Use water spray to keep exposed containers cool. Water spray may be used to disperse liquid and dilute to nonflammable mixture. Do not enter confined fire space without full Bunker gear, including a positive pressure NIOSH-approved self-contained breathing apparatus.

Unusual Fire and Explosion Hazards:

Fire exposed containers will explode. Vapors are heavier than air and may travel a considerable distance to an ignition source and flashback.

SECTION V - Reactivity Data:

Stability	Unstable	Conditions to Avoid: Heat, sparks, open flame, contact with strong oxidizers.
-----------	----------	---

Stable X

Incompatibility (Materials to Avoid):
Oxidizers, active metals such as Aluminum and Zinc.

Hazardous Decomposition or Byproducts: (Combustion) Carbon Dioxide, Carbon Monoxide, Aldehydes and unidentified organic compounds.

Conditions to Avoid: N/A

Will Not Occur: X

SECTION VI - Health Hazard Data:

Routes of Entry:	Inhalation?	Skin?	Ingestion?
	YES	YES	YES

Health Hazards (Acute and Chronic):

ACUTE: Drowsiness, drunkenness, headache, eye irritation and visual disturbances leading to blindness, coughing, shortness of breath and respiratory tract irritation. In extreme cases can result in collapse and death. Eye irritation may occur.

CHRONIC: Prolonged and repeated skin contact can result in dermatitis. Will be absorbed through the intact skin. Prolonged or repeated over-exposure by all routes can result in damage to the central nervous system, liver, kidneys and eyes, blindness and death.

Carcinogenicity:	NTP	ARC Monographs?	OSHA Regulated?
	NO	NO	NO

A 1985 publication reported teratogenicity in rats inhaling 20,000 ppm 7 hours/day during gestation with little maternal toxicity (Fund. Appl. Tox. 5:727 1985).

Signs and Symptoms of Exposure:

Irritation to nose, throat, respiratory tract and eyes. Headache, dizziness, nausea; changes in urinary output; edema; loss of appetite; jaundice; fatigue.

Medical Conditions: Impaired liver and kidney functions; eye disease; skin and respiratory disorders.

Emergency and First Aid Procedures: Ingestion: Induce vomiting; Inhalation: If overcome by exposure, move the victim immediately to fresh air and provide oxygen if breathing difficult. Keep warm and quiet administer artificial respiration if not breathing. Get medical attention. For eye and skin contact, flush with water for 15 minutes.

SECTION VII - Precautions for Safe Handling and Use:

Steps to be taken in Case Material is Released or Spilled: Dike the spill, eliminate sources of ignition. For large spills, evacuate hazard area. Soak up spill with absorbent material and place in non-leaking containers. Do not flush into drains. Use only grounded equipment to prevent sparking. Wear appropriate protective clothing and equipment. Suppress vapor cloud with water fog.

Waste Disposal Method: May be incinerated or disposed of as a hazardous waste in an approved land fill. Refer to latest EPA or state regulations regarding proper disposal.

Precautions to Be Taken in Handling and Storing:

Store in tightly closed vented containers away from heat, flame, sparks and oxidizing agents. Ground & Bond when dispensing. Use non-sparking tools. Extinguish pilot lights and other sources of ignition until all vapors are gone.

Other Precautions:

Do not reuse contaminated clothing or shoes until cleaned.

SECTION VIII - Control Measures:

Respiratory Protection (Specify Type)

Air supplied only.

Ventilation: Local Exhaust: Explosion-proof ventilation
should be used to control vapor accumulation.

Special: Explosion-proof ventilation.

Mechanical (General):
Explosion-proof

Other:
N/A

Protective Gloves:
Impervious, chemical resistant

Eye Protection: Splash proof safety glasses or goggles as appropriate.

Other Protective Clothing or Equipment:

Chemical protective aprons, boots, and face shield as necessary when splashing may occur.

Work/Hygienic Practices:

Avoid prolonged or repeated contact with skin.

DO NOT USE AIR PURIFYING RESPIRATOR: METHANOL HAS POOR WARNING PROPERTIES AND CARTRIDGES HAVE VERY SHORT BREAK-THROUGH TIMES.

Material Safety Data Sheet

May be used to comply with
OSHA's Hazard Communication Standard,
29 CFR 1910.1200. Standard must be
consulted for specific requirements.

U.S. Department of Labor

Occupational Safety and Health Administration
(Non-Mandatory Form)
Form Approved
OMB No. 1218-0072



IDENTITY (As Used on Label and List)

732 Selant

Note: Blank spaces are not permitted. If any item is not applicable, or no
information is available, the space must be marked to indicate that.

Section I

Manufacturer's Name

12 Smith Company

Emergency Telephone Number

517-555-3905

Address (Number, Street, City, State, and ZIP Code)

12 Smith Street

Telephone Number for Information

517-555-3900

Whalen, DE 99999

Date Prepared

2/2/85

Signature of Preparer (optional)

Section II — Hazardous Ingredients/Identity Information

Hazardous Components (Specific Chemical Identity; Common Name(s))	OSHA PEL	ACGIH TLV	Other Limits Recommended	% (optional)
Acetoxysilane	10 ppm*	10 ppm*		5

*Based on TLV for Acetic Acid which is liberated in curing.

Section III — Physical/Chemical Characteristics

Boiling Point	300°F	Specific Gravity (H ₂ O = 1)	1.05
Vapor Pressure (mm Hg.)	5	Melting Point	N/A
Vapor Density (AIR = 1)	N/A	Evaporation Rate (Butyl Acetate = 1)	1

Solubility in Water

0.1g/100g

Appearance and Odor

Vinegar odor, colored paste

Section IV — Fire and Explosion Hazard Data

Flash Point (Method Used)	Flammable Limits	LEL	UEL
250°F (open cup)		UNK	UNK

Extinguishing Media

Class B

Special Fire Fighting Procedures

Use self contained breathing apparatus to protect against evolved acetic acid.

Unusual Fire and Explosion Hazards

None

Section V — Reactivity Data

Stability	Unstable		Conditions to Avoid Air and moisture causes the material to polymerize.
	Stable	X	Liberating acetic acid.

Incompatibility (Materials to Avoid)

Strong oxidizers can cause the material react, liberating acetic acid.

Hazardous Decomposition or Byproducts

Combustion: Carbon Monoxide 50 ppm; Carbon Dioxide 5000 ppm.

Hazardous Polymerization	May Occur		Conditions to Avoid N/A
	Will Not Occur	X	

Section VI — Health Hazard Data

Route(s) of Entry:	Inhalation? YES	Skin? YES	Ingestion? NO
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Health Hazards (Acute and Chronic)

ACUTE: Will irritate the eye and skin, causing reddening and burning due to acetic acid action. Irritation of the upper respiratory system (nose, throat) may occur if the product is applied over a large area. CHRONIC: None.

Carcinogenicity:	NTP? NO	IARC Monographs? NO	OSHA Regulated? NO
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Signs and Symptoms of Exposure

Skin irritation, burning, eye irritation.

Medical Conditions

Generally Aggravated by Exposure Bronchitis

Emergency and First Aid Procedures Promptly flush eyes with water for at least 15 minutes. Wash with water. Respiratory irritation is transient (short lived). Remove from exposure if irritation occurs.

Section VII — Precautions for Safe Handling and Use

Steps to Be Taken in Case Material is Released or Spilled
Soak up on absorbent material.

Waste Disposal Method

Dispose of as normal waste in accordance with state and federal regulations.

Precautions to Be Taken in Handling and Storing

Store below 90°F. Excessive heat could cause premature reaction (curing) and liberation of acetic acid.

Other Precautions

N/A

Section VIII — Control Measures**Respiratory Protection (Specify Type)**

Organic Vapor.

Ventilation	Local Exhaust Not normally required	Special N/A
	Mechanical (General) Usually adequate	Other N/A

Protective Gloves

Rubber or plastic recommended

Eye Protection

Goggles

Other Protective Clothing or Equipment

N/A

Work/Hygenic Practices

N/A

Material Safety Data Sheet

May be used to comply with
OSHA's Hazard Communication Standard,
29 CFR 1910.1200. Standard must be
consulted for specific requirements.

U.S. Department of Labor

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IDENTITY (As Used on Label and List)
Gasoline

Note: Blank spaces are not permitted. If any item is not applicable, or no information is available, the space must be marked to indicate that.

Section I

Manufacturer's Name Some Oil Company	Emergency Telephone Number 914-555-3400 X214
Address (Number, Street, City, State, and ZIP Code) 100 Industrial Drive Some City, TX 99999	Telephone Number for Information 914-555-3400 X570
	Date Prepared November 20, 1987
	Signature of Preparer (optional)

Section II — Hazardous Ingredients/Identity Information

Hazardous Components (Specific Chemical Identity; Common Name(s))	OSHA PEL	ACGIH TLV	Other Limits Recommended	% (optional)
Blend of Carbon 6 - Carbon 10		900 mg/m ³		
Alipatic/parafinic hydrocarbons				
BENZENE	1 ppm	10 ppm	0.8-2.0	
Organic Lead Compounds			varies	
Toluene	200 ppm	100 ppm		
Xylene	100 ppm	100 ppm		
Unleaded premium gasoline		300 ppm/500 ppm	Short term exposure limit	

Section III — Physical/Chemical Characteristics

Boiling Point	90-410°F	Specific Gravity (H ₂ O = 1)	0.72-0.76
Vapor Pressure (mm Hg.)	400	Melting Point	N/A
Vapor Density (AIR = 1)	3-4	Evaporation Rate (Butyl Acetate = 1)	1

Solubility in Water

Insoluble

Appearance and Odor

Pink liquid, aromatic odor

Section IV — Fire and Explosion Hazard Data

Flash Point (Method Used) 40°F (tag closed)	Flammable Limits	LEL 1.4	UEL 7.6
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Extinguishing Media Dry chemical, Carbon Dioxide, Foam, water fog (product will float and can be reignited on surface of water).

Special Fire Fighting Procedures Cool storage drums with water mist. Evacuate area. Prevent run-off from entering water supply. Do not enter confined space without appropriate protective equipment.

Unusual Fire and Explosion Hazards Water may be ineffective on gasoline fires. Extremely flammable. Vapor accumulation could flash and/or explode.

Section V — Reactivity Data

Stability	Unstable		Conditions to Avoid Prevent vapor accumulation.
	Stable	X	Heat, open flame, sparks and strong oxidizing agents.

Incompatibility (Materials to Avoid)

Oxidizers, acids, bases

Hazardous Decomposition or Byproducts

Carbon Dioxide, Carbon Monoxide and other unidentified organic compounds.

Hazardous Polymerization	May Occur		Conditions to Avoid
	Will Not Occur	X	

Section VI — Health Hazard Data

Route(s) of Entry:	Inhalation?	Skin?	Ingestion?
	YES	YES	YES

Health Hazards (Acute and Chronic) ACUTE: Irritation of eyes, nose and throat. May cause "drunkenness" if exposure is massive. Harmful or fatal, if swallowed.

CHRONIC: Vomiting, diarrhea, insomnia, headache, dizziness, anemia, muscle and nerve damage. Aplastic anemia and leukemia may be caused by Benzene content. Gasoline containing more than 0.1% Benzene must be labeled warning of the Benzene toxicity. Prolonged or repeated skin contact causes dermatitis.

Carcinogenicity:	NTP?	IARC Monographs?	OSHA Regulated?
	YES (Benzene 0.1%)	YES (Benzene 0.1%)	YES (Benzene 0.1%)

Signs and Symptoms of Exposure

Irritation of eyes, nose, throat, nausea, vomiting, diarrhea, insomnia, headache, giddiness, dizziness.

Medical Conditions

Generally Aggravated by Exposure Nerve disease; eye, skin and respiratory disorders; impaired liver or kidney function.

Emergency and First Aid Procedures Remove overcome victim from the exposure. Begin artificial respiration, get medical attention. If skin and eyes are involved, flush with water immediately and for at least 15 minutes. Ingestion - do not induce vomiting.

Section VII — Precautions for Safe Handling and Use

Steps to Be Taken in Case Material is Released or Spilled Dike spill, soak up small spills with absorbent material. Eliminate all ignition sources. Remove leaking containers to detached area. Runoff may create fire or explosion hazard in sewer system. For major spills, get upwind and notify local emergency personnel.

Waste Disposal Method

May be incinerated. Product recovery or recycling recommended. Absorbent should be disposed of and as an ignitable hazardous waste.

Precautions to Be Taken in Handling and Storing Store away from heat, sparks and open flames. Keep away from oxidizers, acids, bases. Drums may be grounded and bonded and equipped with self closing valves.

Other Precautions Gasoline may contain organic lead compounds. These will significantly increase the toxicity of gasoline. Lead poisoning has been the cause of death when gasoline was ingested. Do not siphon by mouth.

Section VIII — Control Measures**Respiratory Protection (Specify Type)**

Organic vapor.

Ventilation	Local Exhaust	General ventilation. Use explosion proof ventilation to prevent vapor accumulation.	Special N/A
	Mechanical (General)	YES, explosion-proof.	Other N/A

Protective Gloves	Impervious	Eye Protection Splash proof chemical safety goggles.
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Other Protective Clothing or Equipment Use in well ventilated area away from ignition sources. Wash with soap and water after handling.

Work/Hygiene Practices

Material Safety Data Sheet

May be used to comply with
OSHA's Hazard Communication Standard,
29 CFR 1910.1200. Standard must be
consulted for specific requirements.

U.S. Department of Labor

Occupational Safety and Health Administration
(Non-Mandatory Form)
Form Approved
OMB No. 1218-0072



IDENTITY (As Used on Label and List)
Stainless Steel Cleaner

Note: Blank spaces are not permitted. If any item is not applicable, or no
information is available, the space must be marked to indicate that.

Section I

Manufacturer's Name The Phone Corporation	Emergency Telephone Number 602-253-8805
Address (Number, Street, City, State, and ZIP Code) 111 West Main Street	Telephone Number for Information 602-991-6000
Phoenix, AZ 85111	Date Prepared 5/26/87
	Signature of Preparer (optional)

Section II — Hazardous Ingredients/Identity Information

Hazardous Components (Specific Chemical Identity; Common Name(s))	OSHA PEL	ACGIH TLV	Other Limits Recommended	% (optional)
Stainless Steel Cleaner	N/A	N/A		100
Sodium Linear Dodecylbenzene Sulfonate	N/A	N/A		
Sodium Silica Fluoride	2.5 mg/m3	2.5 mg/m3		
	(as fluoride dust)			
Sulfamic Acid	N/A	N/A		
Silica Flour	N/A	0.1 mg/m3 (resp. dust)		
Diatomaceous Earth	80 mg/m3 (7.S102)	1.5 mg/m3 (resp. dust)		
Starch		5 mg/m3 (resp. dust)		

Section III — Physical/Chemical Characteristics

Boiling Point	N/A	Specific Gravity (H ₂ O = 1)	1.1
Vapor Pressure (mm Hg.)	N/A	Melting Point	N/A
Vapor Density (AIR = 1)	N/A	Evaporation Rate (Butyl Acetate = 1)	N/A
Solubility in Water Moderate			
Appearance and Odor Off-white abrasive powder with pleasant odor			

Section IV — Fire and Explosion Hazard Data

Flash Point (Method Used) Nonflammable	Flammable Limits	LEL N/A	UEL N/A
Extinguishing Media Water or other media suitable for surrounding fire.			
Special Fire Fighting Procedures Cool fire-exposed containers with water. Under extreme heat, use self-contained breathing apparatus. Wear Protective clothing.			

Unusual Fire and Explosion Hazards **Dry powdered material builds static charge when subject to friction.
Use with care around flammable liquids.**

Section V — Reactivity Data

Stability	Unstable		Conditions to Avoid Extreme heat
	Stable	X	

Incompatibility (Materials to Avoid) Ammonia, chlorine, nitric acid, hydrochloric acid, strong alkali, powerful oxidizers

Hazardous Decomposition or Byproducts

Sulfur Oxides, Toxic Fluorine Compounds, Carbon Monoxide, Ammonium bisulfate

Hazardous Polymerization	May Occur		Conditions to Avoid
	Will Not Occur	X	

Section VI — Health Hazard Data

Route(s) of Entry: Inhalation? YES Skin? YES Ingestion? YES

Health Hazards (Acute and Chronic)

See Attachment

Carcinogenicity: NTP? No IARC Monographs? No OSHA Regulated? No

Signs and Symptoms of Exposure

Irritation of the upper respiratory tract and eyes. Symptoms include coughing, dyspnea, sneezing, throat irritation. Skin contact may produce irritation and drying.

Medical Conditions

Generally Aggravated by Exposure Impaired respiratory function.

Emergency and First Aid Procedures

Flush eyes and skin for at least 15 minutes. Inhalation - remove to fresh air. If continued irritation or difficulty in breathing, get medical attention.

Section VII — Precautions for Safe Handling and Use

Steps to Be Taken in Case Material is Released or Spilled

Sweep up and containerize. Vacuuming or wet sweeping may be used to avoid dust dispersed.

Waste Disposal Method

Dispose in accordance with federal and state regulations.

Precautions to Be Taken in Handling and Storing

Store in cool dry ventilated area. Protect against physical damage wash thoroughly after handling.

Other Precautions

Prevent dust suspension.

Section VIII — Control Measures

Respiratory Protection (Specify Type)

NIOSH-approved Dust Respirator

Ventilation	Local Exhaust Preferred, if silica dust exposure high	Special N/A
	Mechanical (General) See above	Other N/A

Protective Gloves

General purpose

Eye Protection

Safety goggles

Other Protective Clothing or Equipment

Lab coats, uniforms or overalls

Work/Hygiene Practices

Launder soiled clothing.

Material Safety Data Sheet

May be used to comply with
OSHA's Hazard Communication Standard,
29 CFR 1910.1200. Standard must be
consulted for specific requirements.

U.S. Department of Labor

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IDENTITY (As Used on Label and List)

STEEL ALLOYS

Note: Blank spaces are not permitted. If any item is not applicable, or no
information is available, the space must be marked to indicate that.

Section I

Manufacturer's Name

A Steel Company

Emergency Telephone Number

213-555-1111

Address (Number, Street, City, State, and ZIP Code)

189 Eighth Street

Telephone Number for Information

213-555-5307**Sometown, MI 99999**

Date Prepared

12/12/85

Signature of Preparer (optional)

Section II — Hazardous Ingredients/Identity Information

Hazardous Components (Specific Chemical Identity; Common Name(s))	OSHA PEL	ACGIH TLV	Other Limits Recommended	% (optional)
Iron	10 mg/m3	5 mg/m3 (As Iron Oxide)		90-100
Carbon	3.5 mg/m3			.01-1.5
Chromium	0.5 mg/m3 (sol salts)	0.5 mg/m3		.01-12
Manganese	5 mg/m3 (ceiling)	5 mg/m3 (as dust ceiling)		.05-2.0
Nickel	1 mg/m3 (ceiling)	1 mg/m3		01-10
Lead	0.05 mg/m3	0.15 mg/m3 (dust, & fume)		.15-.35
Tungsten	--	--		0-18

Section III — Physical/Chemical Characteristics

Boiling Point	5000°F	Specific Gravity (H ₂ O = 1)	7.8-8.2
Vapor Pressure (mm Hg.)	N/A	Melting Point	Approx. 2500°F
Vapor Density (AIR = 1)	N/A	Evaporation Rate (Butyl Acetate = 1)	N/A

Solubility in Water

Insoluble

Appearance and Odor

Gray - Black metal, odorless**Section IV — Fire and Explosion Hazard Data**

Flash Point (Method Used)	Flammable Limits	LEL	UEL
N/A - not combustible		N/A	N/A
Extinguishing Media			
N/A			
Special Fire Fighting Procedures			
N/A			
Unusual Fire and Explosion Hazards			
N/A			

STEEL ALLOYS

Section V — Reactivity Data

Stability	Unstable		Conditions to Avoid
	Stable	X	None

Incompatibility (Materials to Avoid)

Reacts with strong acids to liberate explosive hydrogen gas

Hazardous Decomposition or Byproducts

Metallic oxides

Hazardous Polymerization	May Occur		Conditions to Avoid
	Will Not Occur	X	N/A

Section VI — Health Hazard Data

Route(s) of Entry:	Inhalation?	Skin?	Ingestion?
	YES	NO	YES
Health Hazards (Acute and Chronic) ACUTE: Inhalation of fumes may result in chill and fever for 12 to 48 hours. Metal fume fever - metallic taste, throat irritation and flu-like symptoms.			
CHRONIC: Chromium manganese and nickel fumes may cause lung disease, lead fumes can damage kidneys and affect muscle strength.			

Carcinogenicity:	NTP?	IARC Monographs?	OSHA Regulated?
	YES - nickel & chromium	YES - nickel & chromium	NO

Signs and Symptoms of Exposure

Dust, welding fumes: Metallic taste; nausea; tightness of chest, fever, irritation of eyes, nose, throat and skin.

Medical Conditions

Generally Aggravated by Exposure Chronic lung disease; allergic conditions.

Emergency and First Aid Procedures

Dust, welding fumes: Remove to fresh air. Eye/skin contact: Flush with water.

Section VII — Precautions for Safe Handling and Use

Steps to Be Taken in Case Material is Released or Spilled

Chips and dust should be swept up and placed in suitable container.

Waste Disposal Method

Dispose of as hazardous waste; follow applicable regulations.

Precautions to Be Taken in Handling and Storing

Use good housekeeping to minimize particle accumulation.

Other Precautions

Ventilate welding, brazing, burning and grinding operations.

Section VIII — Control Measures

Respiratory Protection (Specify Type)

Dust/fume respirator.

Ventilation	Local Exhaust Required for welding, grinding operations.	Special
		N/A
	Mechanical (General)	Other
	N/A	N/A

Protective Gloves

As needed based on operation

Eye Protection

As needed

Other Protective Clothing or Equipment

Maybe needed for grinding, welding, etc.

Work/Hygiene Practices

N/A

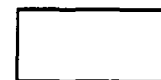
APPENDIX B
HAZARD WARNING LABELS

Chemical/Common Name: Methanol, Wood Alcohol

NSN/LSN: 5910-01-018-3021

Part Number: 5160-081

Item Name:



HAZARD CODE

HAZARDS

ACUTE
(IMMEDIATE)

CHRONIC
(DELAYED)

NONE

SLIGHT

MODERATE

SEVERE

HEALTH		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
CONTACT		<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
FIRE		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
REACTIVITY		<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

SPECIFIC HAZARDS and PRECAUTIONS (INCLUDING TARGET ORGAN EFFECTS)

DANGER! Flammable Liquid

Acute: Overexposure to vapors may cause drowsiness, headache, nausea, visual disturbances, blindness. May irritate lungs and cause coughing, shortness of breath, collapse and death. Liquid is absorbed through intact skin. Causes skin and eye irritation.

Chronic: May damage the central nervous system; may cause liver enlargement; may cause blindness.

Flammable! Avoid oxidizers, active metals, e.g. aluminum, zinc.

PROTECT: EYE ☒ SKIN ☒ RESPIRATORY ☒

Name ABC Chemical Company

Address 2345 Flower Street, Any City, NW 00078

Emergency Telephone (978) 555-0987

See MSDS for Further Information

Chemical/Common Name: 1,1,1-Trichloroethane, Methyl Chloroform

NSN/LSN: 6810-00-292-9625

Part Number: 0-T-620

Item Name: 1,1,1-Trichloroethane, Technical

HAZARD CODE

HAZARDS

ACUTE
(IMMEDIATE)





CHRONIC
(DELAYED)

NONE

SLIGHT

MODERATE

SEVERE

HEALTH		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
CONTACT		<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
FIRE		<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
REACTIVITY		<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

SPECIFIC HAZARDS and PRECAUTIONS (INCLUDING TARGET ORGAN EFFECTS)

DANGER!

Acute: Overexposure to vapors may cause headache, dizziness, unconsciousness, irregular heart beat and death. Prolonged or repeated skin contact may cause skin irritation.

Chronic: High concentration may cause reproductive abnormalities. Avoid open flames and high temperatures; in fire, highly toxic fumes emitted.

PROTECT: EYE ☒ SKIN ☒ RESPIRATORY ☒

Name ABC Chemical Company

Address 2345 Spring Street, Anytown, TA 00234

Emergency Telephone (987) 555-0987

See MSDS for Further Information

CHEMICAL NAME

HAZARD:

Irritant, Moderate Eye

CAUTION!

MAY CAUSE EYE IRRITATION

Avoid contact with eyes.

Wash thoroughly after handling

FIRST AID: In case of contact, immediately flush eyes with plenty of water.

Call a physician if irritation persists.

For additional information, see Material Safety Data Sheet (MSDS) for this chemical.

ABC CHEMICAL COMPANY

One Industrial Drive
Anytown, NJ 08010

CHEMICAL NAME

HAZARDS:

Irritant, Severe Respiratory
Toxic by Absorption
Liquid

WARNING!

**CAUSES RESPIRATORY TRACT IRRITATION
HARMFUL IF ABSORBED THROUGH SKIN**

Avoid breathing vapor or mist
Avoid contact with eyes, skin, and clothing.
Keep container closed.
Use with adequate ventilation.
Wash thoroughly after handling.

FIRST AID: If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Call a physician.

In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. Destroy contaminated shoes.

For additional information, see Material Safety Data Sheet (MSDS) for this chemical.

ABC CHEMICAL COMPANY

One Industrial Drive
Anytown, NJ 08010

CHEMICAL NAME

HAZARDS OF MIXTURE:

Irritant, Severe Skin, Moderate Eye

Kidney Damage (Delayed) Based on Animal Data

Nervous System Damage (Delayed) Based on Animal Data

Components A and B Contribute Substantially to the Hazards

WARNING!

CAUSES SKIN AND MAY CAUSE EYE IRRITATION

CONTAINS A WHICH MAY CAUSE KIDNEY DAMAGE AND NERVOUS
SYSTEM EFFECTS BASED ON ANIMAL DATA

Risk of damage and effects depends upon duration and level of exposure

Avoid contact with eyes, skin and clothing.

Wash thoroughly after handling.

FIRST AID: In case of contact, immediately flush eyes and skin with plenty of
water. Call a physician. Wash clothing before reuse.

Contains B.

For additional information, see Material Safety Data Sheet (MSDS) for this material.

ABC CHEMICAL COMPANY

One Industrial Drive
Anytown, NJ 08010

CHEMICAL NAME

HAZARDS OF MIXTURE:

Strong Sensitizer. Lungs

Irritant. Severe Eye

Reproductive System Effects Based on Animal Data

DANGER!

**MAY CAUSE SEVERE ALLERGIC RESPIRATORY REACTION
CAUSES EYE IRRITATION**

**CONTAINS MATERIAL WHICH MAY CAUSE REPRODUCTIVE SYSTEM
EFFECTS BASED ON ANIMAL DATA**

Do not breathe dust or vapor.

Avoid contact with eyes.

Keep container closed.

Use only with adequate ventilation.

Wash thoroughly after handling.

FIRST AID: If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Get medical attention immediately. Remove material from skin and clothing.

Before using, read Material Safety Data Sheet (MSDS) for this material.

ABC CHEMICAL COMPANY

One Industrial Drive
Anytown, NJ 08010

APPENDIX C
HAZARDOUS CHEMICAL INVENTORY

Product Name	Manufacturer	Use Point
Acetone	Best Chemical Corp.	Pitkin Shop
AC Dark Blue Lacquer	American Paint Co.	Base Shop East Base Shop East Depot Yukon Depot
AC Lt. Blue Lacquer	American Paint Co.	Base Shop East Base Shop East Depot Walnut Depot Yukon Depot
Air Lube	Panfax Oil Corp.	Base Shop East Base Shop
All-Purpose Cutting Fluid Ammonia	Jones Industrial Corp. Weston Chemical	Maintenance Shop Plant Service Jamaica Shop
Anti-Freeze	Texas Oil Co.	East Depot 239th Street Maintenance Shop
Blue Spray Paint	Presco Paints	East Shop East Depot Paint Shop Walnut Depot Yukon Depot
Clear Spray	Chemco	Power Test Station
Contact Adhesive D-220	Jones Industrial Corp.	Pitkin Shops
Epoxy Paint - Beige 201	Federated Paints	Paint Shop
Epoxy Paint - Blue 207	Federated Paints	Paint Shop
Freon 22	Applied Gases	Maintenance Shop Pelham Shop Pitkin Shop
Grease Lube, Dimethyl Polysiloxane	Freehold Products	East Base Shop Maintenance Shop
Light Hydraulic Oil	Texas Oil Co.	Plant Maintenance

Product Name	Manufacturer	Use Point
Linseed Oil	Smith Brothers	Power Test Station Truck Storage Yard
Methanol/Wood Alcohol	Chemco	East Depot
Mercury	Best Chemical Corp.	Pitkin Shop
No. 901 Cleaner	Jones Industrial Corp.	Maintenance Shop
Parts Cleaning Fluid	Grover Parks	Maintenance Shop
Potassium Silver Cyanide	Best Chemical Corp.	Pitkin Shop
Refrigeration Oil	Sunco	East Depot Jerome Shop
Sodium Hydroxide	ZZ Chemicals	Pitkin Shop
Soluble Cutting Oil	Panfax Oil Corp.	Maintenance Shop Machine Shop
Stop-Rust, Black	National Paint Co.	East Depot Signal Shop
Sulfuric Acid	Best Chemical Corp.	Signal Shop
Tight-Bond Cement	Jones Industrial Corp.	Car Repair Shop
Tight-Seal	Jones Industrial Corp.	East Base Shop Walnut Depot
Trisodium Phosphate	H.B.H. Corporation	Pitkin Shop
Urethahold	Jones Coatings	East Base Shop Jerome Shop
ZZ-Off	ZZ Chemicals	Signal Shop
1,1,1-Trichloroethane	Best Chemical Corp.	Base Shop Signal Shop

APPENDIX D
GLOSSARY

Administrative Controls

Use of information, training, shift schedules, work practices, housekeeping, and monitoring to reduce or eliminate exposures.

Airborne

Word used to describe something that is in the air.

Air-Purifying Respirator

Type of personal protective equipment that uses a special filter or chemical cartridge to remove specific airborne hazards from contaminated air before the wearer inhales it.

Air-Supplied Respirator

Type of personal protective equipment that supplies the air that the wearer breathes; includes self-contained breathing apparatus and hose-type supplied-air units.

Barrier Cream

Protective cream applied to the skin to protect against skin contact/absorption hazards; often used in addition to gloves.

Boiling Point

Temperature at which a liquid changes into a gas.

Carcinogen

Health hazard that causes cancer in the exposed individual.

Chemical Container

Bags, barrels, bottles, boxes, cans, cylinders, drums, reaction vessels, storage tanks, and other vessels used to hold chemicals.

Chemical Formula

Way of identifying chemical materials by showing the number of each type of atom contained in one molecule of the chemical.

Chemical Hazard

Any chemical material that can cause health problems, fire, explosion, or other dangerous situations.

Combustible Liquid

Liquid having a flash point at or above 100°F, but below 200°F.

Combustion

The process of burning.

Compressed Gas

Gas stored inside a container at a pressure much higher than normal air pressure; contains a lot of stored energy; a physical hazard due to the potential for sudden release of the stored energy when the gas expands.

Condensation

Process by which an airborne vapor becomes a mist or fume.

Corrosive

Health hazard that burns on contact, causing visible damage and/or irreversible changes to body tissues; also a physical hazard that can burn through inert materials.

Cryogenic

Health hazard that freezes body tissues on contact.

Cubic Meter

A cube measuring 1 meter on each side.

Decomposition Product

Chemical that forms when a material breaks down into simpler molecules; may be hazardous even if the parent material is not.

Degree of Hazard

Measure of how serious an exposure is based on what can happen as a result; takes into account the chemical, exposure route, dosage, number and length of exposures, and individual differences.

Delayed Effect

Health effect that appears slowly over time, rather than right away; can be associated with either single or repeated exposures.

Dermatitis

Cracked, broken, dry skin caused by exposure to health hazards that remove fat from the skin; inflammation of the skin caused by direct contact or systemic exposure to hazardous chemicals.

Dosage

Amount of chemical that enters the body over a specified period of time.

Dust

Airborne particles formed from solids.

Engineering Controls

Use of substitution, isolation, or ventilation to reduce exposure to chemical hazards and the injury or illness caused by such exposure.

Environmental Monitoring

Type of administrative control that involves collecting, measuring, and analyzing air or wipe samples of chemical substances to determine whether a hazard exists, or whether a known hazard is being effectively controlled.

Esophagus

Tube that leads from the throat to the stomach.

Evaporate

Process by which liquids change into the vapor form.

Evaporation Rate

Physical data on the MSDS that describes how fast a liquid evaporates in comparison to a standard having a rate of 1.

Explosive

Chemical material that can undergo a sudden and violent release of pressure and heat.

Explosive Limits

Data on the MSDS that define the ranges of air-chemical mixtures that can explode when exposed to an ignition source; see Upper and Lower Explosive Limits.

Exposure Limit

The maximum amount of chemical in a given volume of air to which workers may be exposed, as averaged over a specified period of time. Most people can be exposed to this airborne limit for an entire working lifetime without developing health effects.

Exposure Symptom

Health effect produced by exposure to a chemical material, such as headache or skin irritation.

Extinguishing Medium

Chemical used to put out a fire.

Eye Contact Hazard

Chemical material that damages or irritates the eye on contact or is systemically absorbed (with either with the bulk chemical or its airborne forms), or that can be absorbed through the eyes; an exposure route.

Chemical Family

Name given to a group of chemicals having related structures or properties (e.g., aliphatic hydrocarbons).

Fire Hazard

Chemical material that ignites and burns easily, or that cause or supports fire in other materials; includes pyrophorics, flammables, combustibles, and oxidizers.

Flammable Liquid

Liquid having a flash point below 100°F.

Flash Point

Lowest temperature at which a liquid gives off enough vapor to ignite in the presence of an ignition source.

Fume

Tiny airborne particles that can form when a solid is melted.

Gas

Physical form of a chemical that is easily compressed and expands to fill its container; has a boiling point below room temperature.

General Ventilation

Type of ventilation system that is used to mix an airborne a hazard with fresh air to dilute it and reduce its concentration to safe levels.

Hazard Communication Program

Written document that describes how an employer or facility complies with all requirements of the Federal Hazard Communication Standard (29 CFR 1910.1200).

Hazard Communication Standard

Federal law developed by OSHA to reduce illness and injury caused by chemical hazards in the workplace; requires evaluation of chemical hazards and communication of hazard information to both employers and employees.

Hazard Determination (or Evaluation)

Process of finding out whether a chemical material is hazardous and what the hazards are.

Hazardous Chemical Inventory

List of all hazardous chemicals known to be present in a given workplace; identity/name of chemicals used on this list must match the identity/name used on the warning labels and MSDSs.

Hazardous Ingredient

Chemical in a mixture that presents either a physical hazard or a health hazard.

Health Hazard

Any chemical material that can cause illness or injury when a person is exposed by ingestion, skin or eye contact, skin absorption, or inhalation.

High Toxicity

Description applying to chemicals that can produce either life-threatening or seriously disabling health effects.

Housekeeping

An administrative control that involves containing and removing chemical hazards — e.g., vacuuming, proper storage and handling, prompt removal and correct disposal of chemical wastes.

IARC

International Agency for Research on Cancer.

Immediate Effect

Health effect that appears right away — either during the exposure or shortly afterwards.

Industrial Hygienist

Expert in the recognition, evaluation, and control of safety and health hazards.

Ingestion

The way that a chemical enters the body if you swallow it; an exposure route.

Ingredient

See Hazardous Ingredient.

Inhalation

The way that a chemical enters the body when you breathe it through your nose or mouth; an exposure route.

International Agency for Research on Cancer (IARC)

Agency that evaluates the research data on substances tested for their carcinogenic potential. IARC publishes information on carcinogens and potential carcinogens. The IARC listing is one of the references that must be used to identify cancer-causing chemicals on MSDSs.

Irritant

Health hazard that reacts with body tissues at the point of contact causing reddening, itching, tearing, irritation, and/or minor inflammation.

Isolation

Engineering control that involves using an enclosure, barrier, or safe distance to separate workers from exposure hazards.

LEL

See Lower Explosive Limit.

Liquid

Physical form of a chemical that has no definite shape, but takes the shape of its container; has a boiling point above room temperature.

Local Exhaust Ventilation

Type of ventilation system that captures an airborne hazard as it is released at the source and takes it out of the workplace.

Low Toxicity

Description applying to chemicals that produce only minor health effects — effects that usually go away with or without medical attention when exposure stops.

Lower Explosive Limit (LEL)

Data on the MSDS that defines the minimum amount of airborne chemical that must be present in an air-chemical mixture to make it explosive.

Material Safety Data Sheet (MSDS)

Written document that identifies a chemical material; gives its physical properties; describes known physical hazards, health hazards, and required controls; and identifies correct procedures for putting out fire, cleaning up a spill or leak, disposing of waste, and handling/storing the material safely.

Medical Monitoring

Type of administrative control that involves physical examinations and/or lab tests to establish an individual's baseline health status and check the effectiveness of other controls used to protect an individual from health hazards.

mg/m^3

See Milligrams Per Cubic Meter.

Milligrams Per Cubic Meter (mg/m^3)

Unit used to express exposure limits; defines the mass of chemical contaminant (in milligrams) allowed in each cubic meter volume of air.

Mist

Airborne form of a liquid chemical; consists of tiny droplets.

Mixture

Material that contains more than one chemical.

Moderate Toxicity

Description applying to chemicals that produce health effects requiring medical attention; damage may be permanent but is neither life-threatening nor seriously disabling.

Monitoring

An administrative control that checks the effectiveness of other controls by analyzing air samples, wipe samples, and personal exposure levels; may involve medical monitoring.

MSDS

See Material Safety Data Sheet.

Mutagen

Reproductive hazard that causes genetic changes in sperm or egg cells.

National Toxicology Program (NTP)

Organization that funds and conducts research on chemical substances. NTP publishes lists of carcinogens and potential carcinogens; this list is one of the reference sources that must be used to identify cancer-causing chemicals on MSDSs.

NTP

See National Toxicology Program.

Occupational Safety and Health Administration (OSHA)

Federal agency within the Department of Labor that develops and enforces standards for workplace safety and health.

OSHA

See Occupational Safety and Health Administration.

Oxidizer

Chemical material that supplies the oxygen required to start or support fire. Common oxidizers include chlorine gas, oxygen and peroxides.

Parts Per Million (ppm)

Unit used to express exposure limits; defines parts of the chemical allowed in each one million (1,000,000) parts of the air-chemical mixture.

PEL

See Permissible Exposure Limit.

Permissible Exposure Limit (PEL)

Exposure limit set and enforced by OSHA. (See Exposure Limit).

Personal Monitoring

Type of administrative control that involves the worker's wearing a badge or other sampling device to measure exposure to a chemical hazard in the workplace.

Personal Protective Equipment (PPE)

Equipment that protects the individual who wears it by placing a barrier between that individual and a hazard; includes protective eyewear, face shields and masks, gloves, boots, hats, clothing, and respirators.

Physical/Chemical Characteristics

Information on the MSDS that describes the appearance, odor, boiling point, vapor pressure, vapor density, evaporation rate, specific gravity, and water solubility of a chemical material.

Physical Hazard

Any chemical material that can cause fire, explosion, violent chemical reactions, or other similarly hazardous situations.

Polymerization Hazard

Unstable chemical that undergoes a violent reaction and release of energy that produces or releases a hazard when two or more small molecules combine (self-react) to form large molecules called polymers.

PPE

See Personal Protective Equipment.

PPM

See Parts Per Million.

Pyrophoric

Chemical material that spontaneously bursts into flame when exposed to air at temperatures below 130°F; no ignition source is needed.

Reactive Chemical

Material that reacts violently on contact with certain other chemical materials to produce or release a hazard.

Recommended Exposure Limit (REL)

Exposure limit recommended by the National Institute for Occupational Safety and Health (NIOSH).

REL

See Recommended Exposure Limit.

Reproductive Hazard

Health hazard that targets the human reproductive system; category that includes teratogens and mutagens.

Sensitizer

Health hazard that produces an allergic-like reaction in some people after repeated exposure.

Skin Absorption

Way that some chemicals pass through the skin on contact and enter the bloodstream; an exposure route.

Skin Contact Hazard

Chemical material that damages or irritates the skin on contact; an exposure route.

Smoke

An airborne mixture of fire gases, dust, and fumes.

Solid

Physical form of a chemical that has a definite shape.

Solubility in Water

Physical data element on the MSDS that describes whether or not a material dissolves in water.

Specific Gravity

Physical data on the MSDS that describes whether a liquid is lighter or heavier than water.

Substitution

Engineering control that involves replacing a chemical, process, or piece of equipment with a less hazardous one.

Target Organ Chemical

Health hazard that enters the bloodstream and damages specific internal organs or body systems; effects can be delayed.

Teratogen

Reproductive hazard that damages the fetus during its development.

Threshold Limit Value (TLV)

Exposure limit recommended by the American Conference of Governmental Industrial Hygienists (ACGIH). (See Exposure Limit).

TLV

See Threshold Limit Value.

Toxicity

Description of the degree of health hazard associated with exposure to a chemical; see Low, Moderate, and High Toxicity.

Transfer Container

Chemical container that does not require labels because only one person handles the container, and it is filled and emptied during the same shift.

UEL

See Upper Explosive Limit.

Unstable Chemical

Material that violently self-reacts under commonly occurring conditions; a type of physical hazard.

Upper Explosive Limit (UEL)

The maximum amount of airborne chemical that can be present in an air-chemical mixture and still have it be explosive.

Vapor

One airborne form of a liquid chemical.

Vapor Density

Physical data that describes whether the vapor formed by a material is lighter or heavier than air.

Vapor Pressure

Force exerted on the walls of a closed container of liquid by vapor formed above the liquid surface.

Vaporization

Process by which liquids become airborne.

Ventilation

Engineering control that reduces airborne exposure levels either by mixing the hazard with fresh air, or by removing it as it is released at the source.

Warning Label

Document affixed to chemical containers (or posted by stationary containers) that identifies the chemical material and all appropriate hazard warnings.

Water-Reactive

Chemical material that reacts with water or moist air to produce or release a hazard.

Work Practices

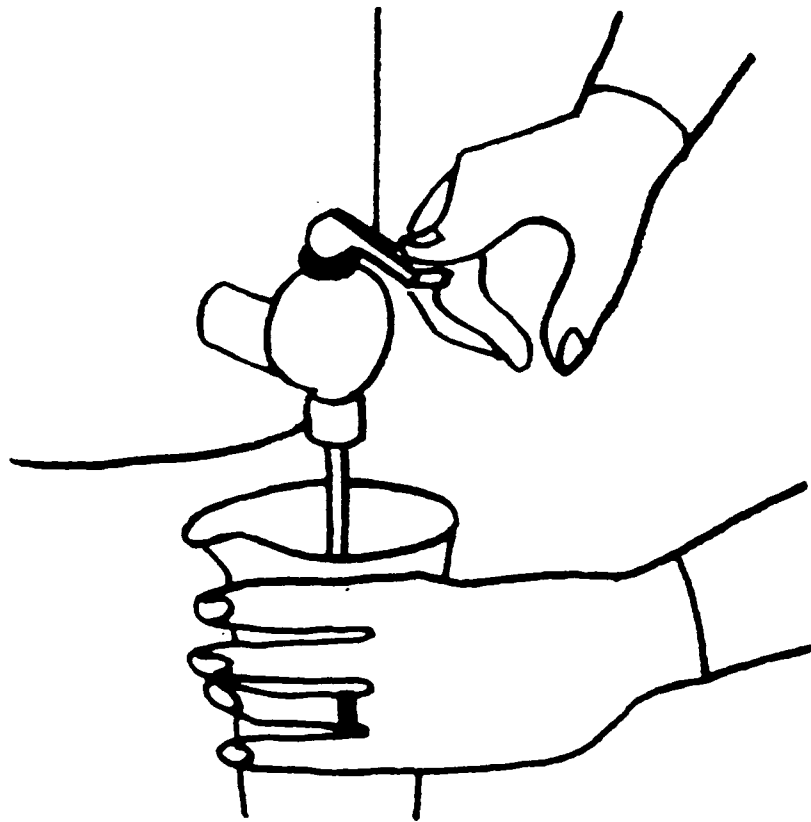
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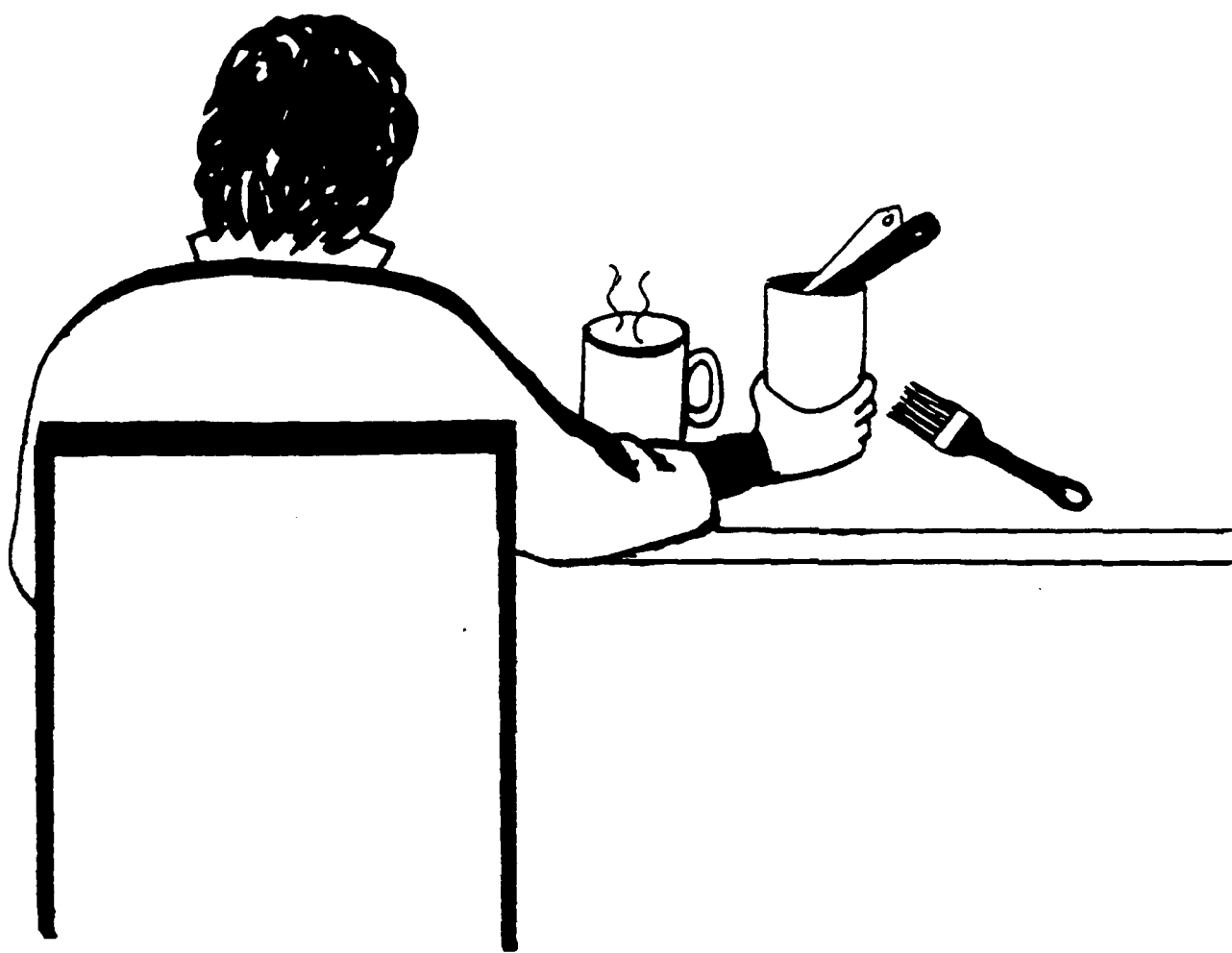
APPENDIX E
OVERHEAD MASTERS

**DO NOT USE NEAR FIRE OR FLAME.
HARMFUL IF SWALLOWED, INHALED, OR
ABSORBED THROUGH SKIN.**

	DUST	SMOKE	FUME	VAPOR	MIST	GAS
WELDING		X	X			X
SPRAY PAINTING						
GRINDING						
BRUSH PAINTING						
SANDING						
SWEEPING						
SOLDERING						
DEGREASING						
DIPPING						







**NEVER USE OR MIX WITH OTHER CHEMICALS.
KEEP OFF ALUMINUM UTENSILS AND OTHER
ALUMINUM-CONTAINING MATERIALS**

